THE
ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

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	Page
The Marconi Contract	121
The Ferranti Steam-Gas Turbine	122
British Electrical Superannuation Fund	122
Copper	123
Electrical Devices for Measuring the Inflammability of Coal Dust (*illus.*)	123
The National Insurance Act, 1911	124
The Electric Drive in the Wood-working Yard (*illus.*)	125
Correspondence:—	
Screw Caps for Radiator Lamps	127
The Case of the Sub-Man	127
The Association of Electrical Station Engineers	128
Village Lighting	128
The Regulation of Street Traffic	129
British Laboratories for Electrical Goods	129
Electrical Trade in China	130
Small Power Installations	130
New Electrical Devices, Fittings and Plant (*illus.*)	131
Legal	133
Business Notes	135
Notes	144
City Notes	147
Stocks and Shares	148
Share List of Electrical Companies	149
Control of Three-Phase Variable Speed A.C. Motors (*illus.*)	151
Graphs in a Cable-Ship Drum-Room: Notes for Junior Assistants (*illus.*) (*continued*)	152
Proceedings of Institutions:—	
The Steam-Gas Turbine	154
The Design of Apparatus for Improving the Power-Factor of Alternating-Current Systems (*illus.*)	155
Australian Wireless Telegraphy (*illus.*)	159
New Patents Applied For, 1913	160
Abstracts of Published Specifications	160
Contractors' Column	Advertisement pages xxii, xxiv and xxvi

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THE MARCONI CONTRACT.

THE letter addressed by the managing director of the Marconi Co. to the Postmaster-General, and by him communicated to the Select Committee which is now inquiring into the contract provisionally signed, is a somewhat exceptional document. Its object is to express the company's desire that they may be relieved from the obligations of that contract, a proceeding to which no exception can be taken as an ordinary business operation, but the rhetoric by which the intimation is accompanied will seem to most people to be somewhat misplaced. Anticipating, as the managing director naively says, that the tender delivered on March 7th would be promptly submitted to Parliament and ratified, they retained "a very large responsible and experienced staff of engineers" in readiness to undertake the work. When the provisional contract was signed on July 19th they were, they think, reasonably entitled to expect that it would be forthwith submitted to Parliament for ratification, but a Select Committee was appointed instead.

Over three months have elapsed, 28 public sittings have been held and many witnesses called, but the Committee has had no evidence "from those best qualified to speak with experience on the subject," and in the meantime erroneous statements, technical and otherwise, "reproduced in the Press of nearly every country in the world," have been detrimental to the company's interests. And now it is proposed to appoint a technical Committee to inquire as to which is the best system, which the company would welcome, provided proper facilities were afforded for testing the evidence to be called before it, though they regret that it was not appointed three months ago. The delays were not contemplated by either party; it is inequitable, says Mr. Godfrey Isaacs, that his company should remain bound, and in order to continue to maintain the company's position "in an important industry developed in and conducted from this country, employing over 2,000 British workers, our engineers must be released, and Mr. Marconi and I must be free to attend to other important work."

The interim report of the Committee made it tolerably clear that the contract would not go through in its original form, so that the company cannot be said to be doing anything particularly heroic in withdrawing from the contract, and expressing their readiness to consider other terms when they are offered.

According to the City editor of the *Westminster Gazette*, the course taken by the company "is generally applauded in Stock Exchange quarters, because it is considered that it is good policy on the part of the company to force the pace as much as they can." To force the pace by unreasoned criticism of the proceedings of a Committee appointed by Parliament which has the decision in the matter seems to us to be of doubtful wisdom, whilst the general tone of the letter is, we fear,

calculated to enlarge the circle of those who hesitate to entrust an important Imperial undertaking to private hands. There is, no doubt, some occasion for irritation to the parties who entered into the contract, but it should be realised that confidence is more likely to be restored by calmness and patience than by a display of irritation. The position and the opportunities of the Marconi Co. may be unrivalled, but they should be used with discretion, at least where Parliament is concerned.

The Ferranti Steam-Gas Turbine.

It has been common knowledge amongst his friends for some years that Dr. Ferranti was engaged upon important investigations in connection with the utilisation of "steam-gas"—*i.e.*, steam superheated to a temperature far above its saturation point—in turbines, but little has hitherto been divulged regarding the details of the work, or the degree of success which had been attained. We are glad, therefore, to be able to reproduce from the James Watt lecture, which he delivered at Greenock last week—a lecture of deep interest throughout—some particulars which indicate the progress that he has made.

The fact that Dr. Ferranti's views have been embodied in a turbine of no less than 5,000 H.P. bears witness to the large scale upon which his experiments have been carried out, and preserves them from the suggestion that laboratory results may not be realised in practice. We are still without information as to the details of the construction which renders stripping impossible in spite of the use of extremely small clearances, but the statement that the H.P.-hour can be obtained with an expenditure of no more than 7 lb. of water at two-thirds load at once stamps the invention as one of the first importance. Not long ago Sir Charles Parsons himself, upon whose foundation modern turbine practice has been built up, expressed the view that the steam turbine had approached the limit of possible economy, but clearly there are still great possibilities of progress.

It will be observed that Dr. Ferranti strongly deprecates the construction of large oil engines, maintaining that the turbine is the right thing for large powers, and in view of the economy he has attained—taking capital cost into consideration also—it seems probable that the incentive to effort in this direction will in future be lacking. The suggestion that the power station of the future will embrace a large gas plant with by-product recovery plant, supplying gas to the boilers and heavy oil and petrol for the use of internal-combustion engines, recalls the views enunciated in "the Ferranti address" of 1910, and indicates that Dr. Ferranti looks forward with undiminished confidence to the dawning of the electrical age then foreshadowed. It will be remembered, too, that he then hinted at the possible successful development of the steam-gas turbine as one of the factors in producing that result. We wish him all success in the realisation of his prophecy.

British Electrical Superannuation Fund.

The British Electrical Superannuation Fund, which was formed about 1900, appears to have had but a short life as such, for we understand that during the past year it was resolved to wind it up as on December 31st, 1911. It would seem that if all retirements took place at the earliest optional age of 60, instead of being spread mainly over the ages from 60 to 65, a deficiency of some £15,000 would be disclosed. When originally formulating the fund it was, we believe, the wish and endeavour of the British Electric Traction Co. to adopt a superannuation scheme capable of application to the possible needs or requirements of the electrical industry generally. The industry, however, with the exception of the City of London Electric Lighting Co., seems to have ignored the idea, and its operations were therefore practically confined to the salaried employés of the British Electric Traction Co. and its subsidiary companies. We understand that in place of the British Electrical Superannuation Fund, a new fund has, been constituted and inaugurated called the British Electrical Endowment Fund, which, however, we gather the City of London Electric Lighting Company has not joined, that company apparently being quite capable of carrying on a fund similar to the British Electrical Endowment Fund. The secession of the City of London Co. means the payment by the British Electrical Superannuation Fund to the City Co. of some £9,000. The managing trustees and the investment trustees of the Endowment Fund are empowered to hold all moneys recently belonging to the Superannuation Fund or investments representing the same, for the purposes of the Endowment Fund, and to apply them as provided by the rules of that fund, which we believe came into operation as from January 1st, 1912.

Copper.

The total European visible supply still keeps fairly level, the figures given in Messrs. Merton's statistical circular being 43,160 tons for January 15th, 1913, against 43,241 tons for December 31st, 1912, the difference of 81 tons being a balance between the decrease in English stocks (1,499 tons), and on quantities afloat (100 tons), and the increase in French, Dutch and German stocks. The supplies are thus close up to deliveries, and show a fair figure (23,371 tons) for the half-month. The North American deliveries to Europe are fairly high; Spain and Portugal send the average quantity to England and France, Chile shipments are high, and Australian just average. If the deliveries were doubled the figures for the month would be fairly good; this, of course, depends upon whether the drop in price is maintained or not.

The world's supplies, including Holland and Germany, stood, at the end of December, at 90,225 tons, an advance on the figure for November of 8,478 tons. American producers' stocks, according to the Association, stood, on the same date, at 47,014 tons, an advance of 8,548 tons on the preceding month. The December production in the States, from the same source, was 64,000 tons, the home consumption taking 25,100 and export 29,330, leaving a surplus to stock.

The figures for each month in the year are given by the *Financial News* for January 9th, showing that this production was only exceeded in August and October, that July was fairly well up to it, the other months being lower, January and February showing least. The home consumption was brisk the first part of the year, reaching its maximum in October at 37,550 tons. The total production for 1912 is given at 706,000 tons, a quantity considerably higher than the 639,000 tons credited to 1911.

The reason for the drop in price, which amounts to £3 15s. since December 31st, is discussed in the *Financial Times* for 17th inst. The writer of the article is not inclined to consider the increase in American stocks a determining factor, but rather attributes it to the situation created by anticipations of continued expansion in commerce generally, and consumption of copper particularly, which have not been realised, tending to overload the market. The consumer also appears to have been apprehensive of a market showing signs of artificial prices, such as could be traced in those of September. Messrs. James Lewis summarise the conditions of trade in 1912, by dividing the year into two periods of six months, in the first of which prices improved, after falling to £61 per ton, under the influence of good trade and decreasing supplies.

The highest point was reached on June 20th, when standard was quoted at £80 cash. Prices were maintained, probably artificially, till the outbreak of war in the Balkans,

with the subsequent uncertainty and trade depression. Messrs. Lewis give the total home consumption of the United States at 410,100 tons, an increase of 113,500 tons over the preceding year. Consumption in Germany also increased by 34,000 tons, or 25 per cent., England and France being, apparently, the only considerable countries which lost ground. The world's consumption is given at 939,000 tons, as against 811,300 tons in 1911. The total production of the world, however, is estimated at 1,015,000 tons, an advance on 1911 of 140,000 tons. The United States increased its output by 71,000 tons, or over 14·5 per cent., and further expansion in low-grade ores is anticipated. Chile has increased her output by 8,000 tons; Mexico, 14,000 tons; Spain and Portugal, 9,700 tons; and Canada, 7,000 tons. Russia and Australia are both increasing production, and much is expected from Central Africa.

Taking into account the upward tendency of production, and the present fairly high price, it seems probable that the average for standard in 1913 will be lower, unless the settlement of the Balkan trouble and improved commercial conditions in this country should unite to give an impetus to consumption.

"The Surveyor."—We note with pleasure that our valued contemporary, *The Surveyor*, arrived at its majority last week, and celebrated the occasion with a special issue dated January 17th. Since its first year, the journal has greatly increased in bulk and circulation, and has attained to a very high standing as the organ of the professions included within its full title—*The Surveyor and Municipal and County Engineer*. During the past 21 years, *The Surveyor* has witnessed vast changes in municipal engineering and in the organisation of municipal government, and has been enabled to play a prominent part in safeguarding the interests of municipal engineers. We believe, too, that, throughout its existence, it has remained in the hands of the original proprietor.

In the special issue, besides a general survey of the period, there are given special reviews of the advances made in electricity supply, highways—a subject which our contemporary has made its own—public buildings, refuse disposal, sewerage, street lighting, tramway progress, water supply, and legislation, the whole constituting a valuable and interesting *résumé* of the remarkable developments which have taken place in each of these important branches of municipal activity.

We congratulate the proprietor and all concerned in the production of this issue and on the attainment of the twenty-first milestone, and hope they will celebrate their jubilee under conditions no less auspicious.

The Curative Waters of Bath.—Last week a number of London doctors visited Bath and attended an informal conference on the radio-active waters of the city. According to the *Times*, Sir William Ramsay, in opening the conference, said the gas from the waters was now bottled up in steel bottles under pressure and used in spraying. There were three methods of profiting by the curative properties of the waters. If they were drunk they should be taken in small quantities and often. In the case of baths, the patient should be made negative in order that the particles given off by the radium could be absorbed through the skin. Where the method of spraying and breathing was adopted the patient should be made negative also, in order that the particles might decompose.

Electroculture in Austria.—An interesting account of results obtained by electroculture at Petrovic (near Prague), appears in a recent issue of the *Elektrotechnische Zeitschrift*. The experiments were carried out during the exceptionally dry summer of 1911, but, on a number of patches under the same management and subject to the same treatment in every respect except electrification, the yield of some crops was twice as great on the electrified as on the "control" areas. The high-tension discharge system was employed, steel wires being stretched across the fields at intervals of 100 yards between insulators mounted on wooden poles; 60 poles were in use in an area of 90 acres. On these steel wires rested a radiating network of 0·2 mm. diameter steel wires placed 10 yards apart. The height of the network was 12 ft. above ground level, so that ordinary carting operations were not hindered. In the small stations supplying the network, a high-frequency current (obtained by the aid of mercury interrupters), was transformed up to 100,000 volts and then rectified before admission to the radiating network. The total power consumption for the 90 acres was 2 amperes at 120 volts. The discharge was maintained only for a few hours per diem, and was necessarily entirely suspended in wet weather; it was purposely interrupted during very hot weather (since experience shows that the discharge treatment is useless or even injurious in the latter case).

The quality as well as the yield of the crops was much improved by the electrical treatment, and it is claimed that, if the radiating network is so designed as to take full advantage of the output from the transformer station, the capital cost of the whole equipment can be recouped by the increased returns during the first year of working.

ELECTRICAL DEVICES FOR MEASURING THE INFLAMMABILITY OF COAL DUST.

THE second Report of the Explosions in Mines Committee to the Home Secretary has been issued, and deals with experiments made to determine the inflammability of various coal dusts.

The degree of "inflammability" of any combustible material can be defined as the degree of ease with which its oxidation can be effected so as to produce flame. It will be seen from this definition that the inflammability of any combustible material depends essentially on its chemical affinity for oxygen. The inflammability must also, however, be affected to a large extent by the physical condition of the combustible material, whereby it is rendered more or less open to attack by the oxygen.

When considering the relative degrees of inflammability of coal dusts, it can be accepted as an axiom that the finer the dust from any particular coal the greater its inflammability. This has been confirmed by a large number of experiments. Bearing this in mind, the consideration of the more important and more complicated problem of the influence of the chemical nature of the coal on the inflammability of the dust from it can at once be proceeded with.

The method of investigation chiefly followed by the Committee has depended upon the destructive distillation of different varieties of coal under different conditions. The apparatus used by the investigators is described below. Accurately weighed quantities of the dust were blown upon

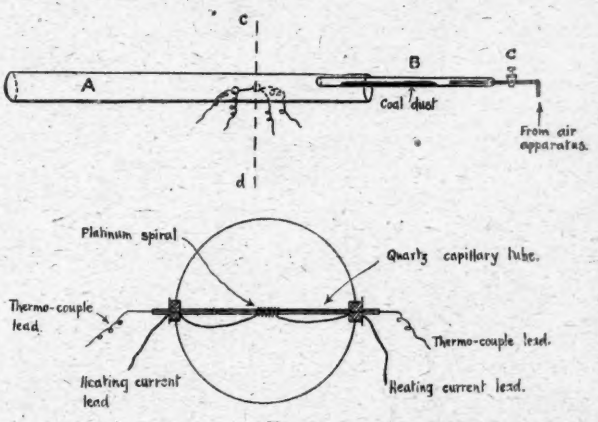


FIG. 1.

a platinum spiral maintained at the same temperature in each case, and their relative inflammabilities were judged by the impulses given to a ballistic pendulum by the sudden expansion consequent on the inflammation of the dust clouds.

Referring to fig. 1, A is a glass cylinder, 8 cm. in diameter and 140 cm. long, open at both ends. A platinum coil of No. 32 gauge wire, closely wound on to a tube of thin-walled quartz of capillary bore, passes horizontally across a diameter of the cylinder at a point 40 cm. from one end. Through the bore of the quartz tube a platinum and platinum-rhodium thermo-couple passes, and is connected to a milli-voltmeter calibrated so as to read temperatures on the Centigrade scale. By means of suitable connections, an electric current can be passed through the spiral, so that it can be heated to any temperature up to about 1,400° C., and maintained at a constant temperature by the adjustment of an external resistance. The length of the spiral is 17 mm., and its diameter 1·5 mm. The coal dust to be tested is blown across the heated spiral as a cloud of a fairly uniform density, successive trials being made until a temperature is found at which general inflammation of the dust cloud takes place.

To obtain the dust cloud, about 2 gm. of the sieved and dried dust is placed in a glass tube of 2·5 cm. internal diameter and 45 cm. long. This tube is closed at one end by a rubber stopper carrying a glass tap of 1 cm. bore. It is supported so that the open end is at a distance of 30 cm.

from the spiral. The tap is connected with an arrangement for giving a constant puff of air.

The method of making the determination is as follows :— The dried and sieved dust is introduced into the tube B so that it lies evenly over its whole length, and the tube is then closed by the rubber stopping and tap, and clamped in position. The platinum coil is then raised to such a temperature as previous trials may have indicated to be about that required. The dust cloud is then produced by suddenly opening the tap C. The air blast passing over the surface of the dust raises the top layer and carries it into the larger tube, and over the heated coil in a cloud that remains uniform during the stroke of the piston. If ignition takes place, the temperature of the platinum coil is lowered 10° or 20° C., and a fresh trial is made, and so on, until two temperatures are obtained, differing by 10° C., at

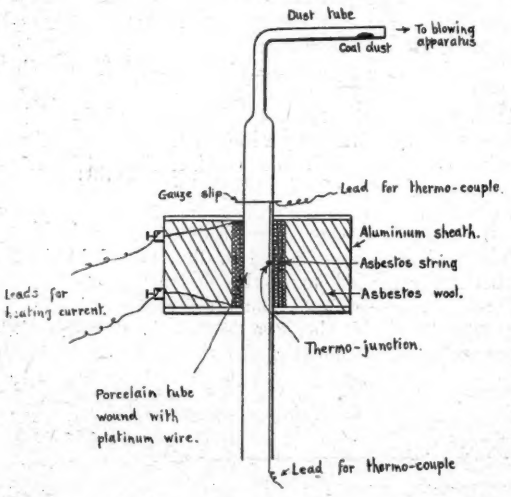


FIG. 2.

one of which inflammation takes place, whilst at the other the dust cloud passes over uninflamed. The mean temperature is then taken to be the ignition temperature of the dust under the conditions of the experiments.

The French mining authorities have carried out experiments dealing with the same problem, and their index of inflammability is the size or length of the flame produced when a given quantity of the dust is blown through a vertical porcelain tube of 25 mm. internal diameter and 10 cm. long, heated to a temperature of 900° C. The Home Office Committee has made similar experiments, employing the apparatus shown in fig. 2.

The dust, carefully sieved and dried, is introduced into the horizontal dust tube, its weight being 0·2 gm. The wide portion of this dust tube is then placed vertically in the small electric furnace, a slip of copper gauze being introduced between the furnace tube and the dust tube. The temperature, measured by a platinum and platinum-rhodium thermo-couple passing through the furnace and in contact with its walls, is then raised to 900° C. and maintained constant. A tap, which connects the dust tube to the apparatus for giving a constant puff of air, is now quickly opened. All the dust in the dust tube is thus projected downwards through the furnace. It ignites, and a flame appears underneath. This flame is photographed, the experiments being made in the dark, and the sensitised plate being exposed a little time before the tap is opened and allowed to remain exposed until all flame has disappeared. It is from the appearance of such flames that the French experimenters judge the relative inflammabilities of the different dusts.

In making these experiments the Committee found that, provided all the experimental conditions were maintained rigidly constant, the size and type of flame obtained from one particular coal remained remarkably constant from one experiment to another. Comparison between one coal and another by means of the photographs of their flames can, therefore, be relied on.

The experiments show that the relative inflammability does not depend upon the total volatile matter, but on the relative ease with which inflammable gases are evolved. The order of inflammability so obtained corresponds in a remarkable degree with the percentage of inflammable matter extracted from the same coals by pyridine. The Committee is of opinion that these two methods form a valuable means of discriminating between different coals in respect of the sensitiveness of their dusts to ignition. It must, however, be noted that these tests have been made with dusts artificially ground and sieved to an equal degree of fineness, and since coals differ considerably in their power of resistance to pulverisation, the friability of a coal must be taken into account.

There are three appendices to the report, dealing with the volatile constituents of coal, the extraction of coal by pyridine, and analyses of coals and their relative ignition temperatures.

THE NATIONAL INSURANCE ACT. 1911.

OUTWORKERS. CONTRACT OF SERVICE.

BY JOS. J. H. STANSFIELD, F.C.I.S.

THE first schedule to the National Insurance Act, 1911, consists of two parts, the first containing a list of employments within the meaning of that part of the Act referring to health insurance, and the second a list of exceptions.

Paragraph *(c)* of the first part provides that insured persons includes outworkers—that is, persons to whom articles or materials are given out to be made up, cleaned, washed, altered, ornamented, finished or repaired, or adapted for sale in the home or other premises not under the control or management of the person who gave out the articles or materials, unless the Insurance Commissioners have by Special Order excluded any particular class or description of such outworkers.

The amount of insurance payable for outworkers in many cases causes difficulty. Where a person is continuously employed by one employer the difficulty is not great, and no hardship is laid either upon employer or worker beyond that entailed by the ordinary employer whose workpeople are engaged upon the premises of the employer, but many outworkers work for more than one employer, or only work at intervals, or are assisted by other members of their family In such cases both employer and worker are placed at a disadvantage ; the employer because of the intermittency of the employment entailing the insurance of a proportionately larger number of employés, and the outworker because more than one contribution per week would be payable, or because deductions would be made when employment might have been available only for a few hours during the week.

Official explanatory leaflet No. 26 shows how this difficulty may be overcome, contributions being payable under two methods. Method A is the ordinary method applicable to insured persons working on the premises of the employer, one contribution being payable for each calendar week (Monday to Sunday) or part of a week in which work is done.

Method B is called the "unit" system of payment, and by this system contributions are payable not according to weeks, but on the basis of the amount of the work done, special cards (A.O. for men and E.O. for women) being issued.

Where outworkers are working for more than one employer and Method A is adopted, the employers may agree to stamp the card in rotation, but if they do not so agree, each employer must, whenever work is brought in, stamp the card for each week or part of a week that has passed since the work was given out, unless contributions in respect of those weeks have been paid by some other employer.

Under Method A, only one contribution is payable for each week, but where Method B is also used and an outworker works for more than one employer, one card must be used for the one or more employers who use Method A, and a separate card for each employer using Method B.

Under this regulation more than one contribution may be payable for the same week, but after 52 contributions have been paid in any year, no further contributions need be paid for the year if the outworker applies to his or her approved society, or to the Insurance Commissioners for a certificate to this effect. On the other hand, an outworker regularly employed by an employer who is using Method A, and by another employer who is using Method B, may call upon the latter employer to also use Method A after the end of any quarter.

Under Method B one contribution is payable for each unit of work, however long or short a time the work may have taken. This unit is an amount of work which earns a certain sum fixed by the Commissioners for each trade, and it is intended to represent the amount an ordinary worker would earn if a full week were worked.

The following are a few samples of "units":—

1. Hand-hammered chain making up to and including $\frac{11}{32}$ in. (*i.e.*, small sizes) 10s.

2. Dollied or tommied chain making and hand-hammered chain making of $\frac{3}{8}$ in. diameter and over up to $\frac{17}{32}$ in. inclusive—20s.

3. The making of boxes or parts thereof made wholly or partially of paper, cardboard, chip and similar material. For female workers 12s.

Where no units have so far been fixed for any particular class of work a general unit of 15s. for male workers and 8s. 9d. for female workers has been fixed by the Commissioners, but where these general units are considered to be under or over the work value of a week, the Secretary of the Insurance Commissioners may be written to and unit values of a different amount may then be prescribed if thought desirable.

If a unit is, say 10s., and a worker brings in work for which 10s. 9d. is payable, two stamps need not be paid, and the extra 9d. may be carried forward towards the next unit. On the other hand, if work is for the first time brought in below the value of a unit, a stamp must be affixed, but no further stamp is payable until the total value of the unit is made up. In reckoning the value of work, any expenses incurred in doing the work must be deducted before arriving at the unit value.

The regulations as to employment of outworkers have recently been amended, and the amended regulations came into force on January 13th of this year. The Official Explanatory Leaflets, Nos. 25 and 26 (revised), deal with the question of outworkers in England.

The second part of the first schedule to the Act provides that outworkers who are the wives of insured persons are not insurable. This exception placed such workers in a better position than other outworkers, and an order has been made by the Commissioners, with the approval of the Treasury, to include such persons.

It is, however, pointed out that the Act provides (Sec. 2) that if she is ordinarily and mainly dependent for her livelihood upon some other person, a certificate of exemption can be obtained by applying to the nearest Customs and Excise officer. No contribution will then be payable by the worker, but the employer will still have to pay his own share of the contributions.

Contract of Service.—Paragraph (*a*) of the first part of the First Schedule to the Act uses the words "contract of service" in determining whether an employé is insurable or not, and cases occur where the Insurance Commissioners are asked to determine whether any particular class of worker comes within the Act.

Such an application was recently made by a number of insurance companies and friendly societies, who wished to know whether agents paid by commission or fees for part time or spare time service to canvass for business or to collect moneys, were employed under a contract for service.

On December 9th last the Commissioners held a public hearing, and decided that agents engaged under the agreements handed in by the companies and societies had to be insured, unless paragraphs (*e*) and (*g*) of the second part of the first schedule to the Act applied.

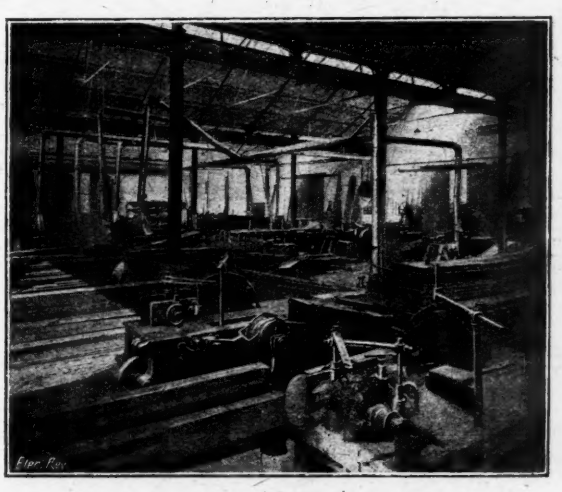
Paragraph *(e)* provides that agents paid by commission or fees, or by a share in the profits, or partly in one and partly in another such way, are not insurable as agents where they are mainly dependent on earnings from some other occupation or where they are ordinarily employed as agent by more than one employer, and his employment under no one of such employers is that on which he is mainly dependent for his livelihood.

Paragraph (*g*) provides that employment otherwise than by way of manual labour at a rate of remuneration exceeding £160 a year, or employment involving part time service only, at a rate of remuneration which, in the opinion of the Commissioners, is equivalent to a rate exceeding £160 a year for whole time service, is not insurable.

THE ELECTRIC DRIVE IN THE WOOD-WORKING YARD.

FEW to-day question the increased economy and efficiency to be obtained by the application of electrical power, but perhaps it has not made such strides in the wood-working industry as in other directions. This is chiefly because the proprietor, as a rule, has had too limited an idea of the benefits to be derived from electric driving. He has looked only for a decreased power bill, and has been quite unaware that an electrical power equipment would enable him to improve and quicken his processes, increase his output, and reduce his labour bill.

Where there is a public electrical supply available, very advantageous terms can often be arranged. But the important economies mentioned above make it advisable to use electrical power, even when no public supply is at hand. In such cases the steam boiler and engine may still be retained (and, if necessary, the wood waste still used as fuel), but instead of mechanically distributing the power through



GENERAL VIEW OF SAWMILL.

shafting and belts, the engine should be used to drive a dynamo, supplying current to drive motors coupled to individual machines or groups of machines.

Wood-working machines are very diverse in their characteristics, and require individual consideration in order to secure the best results. In nearly all cases the load is a very fluctuating one, due to knots, uneven sawing, and nipping of the timber, while there is always the liability of sudden overloads due to these causes. Gradual starting of the tools is a necessity owing to their very high working speed and heavy starting load, as in four-cutter planing and moulding machines, and it is equally necessary to be able to stop immediately in cases of emergency.

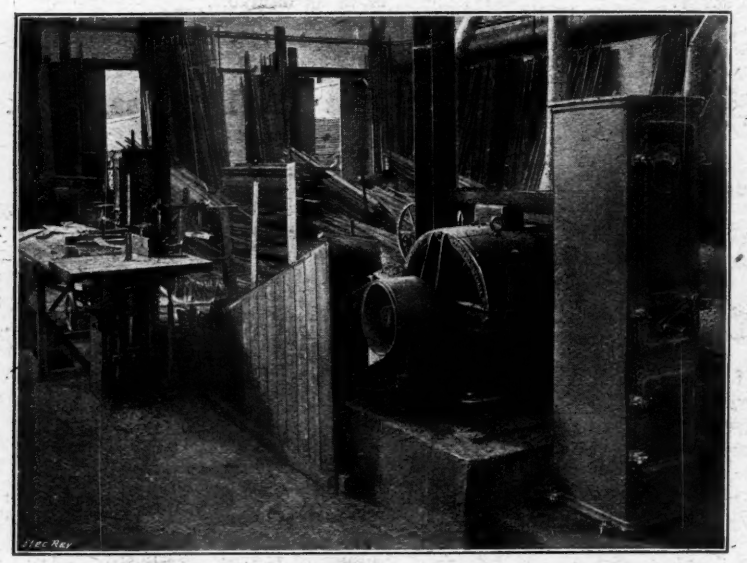
These conditions demand that the switchgear should be simple to manipulate, or it will absorb attention on the part of the workman which should be given to his work.

The motor must be automatically protected by the controlling device against damage arising from failure of voltage or from overloads, and the switchgear must be capable of frequently opening circuit on the occurrence of dangerous overloads, without itself sustaining damage.

D

It is also advisable completely to enclose the switchgear in one substantial housing, as, in spite of the elaborate system of suction pipes, the atmosphere is more or less charged with dust, which tends to percolate everywhere.

A conspicuous example of what may be achieved by a well-planned installation, embodying the most suitable form



Lea Valley Mills: 30-h.p. Motors and "Conspede" Controllers driving Line Shafts.

of control, is afforded by Messrs. Lathom's Lea Valley Mills, of which the following is a brief description:—

The whole lay-out was arranged by the engineers of the Hackney Borough Council's Electricity Installation and Sales Department. The total horse-power at present installed is 280, and the voltage 240 and 480 volts D.C. The largest motor is of 50 H.P., and the smallest 2 H.P.

All the motors are shunt wound, fitted with interpoles, and of the enclosed ventilated type, by Messrs. J. H. Holmes and Co., of Newcastle-on-Tyne. One 50-H.P. motor drives a line of shafting, which drives four 36-in. circular saw-benches. The second 50-H.P. motor drives two log frames of the vertical reciprocating type, by Messrs. Robinson, of Rochdale, each machine being capable of making any number of vertical cuts up to 24 simultaneously from logs up to 30 in. sq. and 12 ft. long.

One 15-H.P. motor drives a log-frame saw of the horizontal reciprocating type, by Messrs. J. Pickle & Son, of Hebden Bridge, which is capable of making one cut up to 48 in., cutting at the rate of 2 in. per minute.

Four 30-H.P. motors each drive a length of shafting, from which various moulding and planing machines, vertical spindles, circular saws and band saws are driven.

Other smaller machines are fixed for working saw-sharpening tools, &c.

The control panels at Messrs. Lathom's mills are all made by the Adams Manufacturing Co., Ltd., of London and Bedford, and of the well-known "Adams Igranic Conspede" type; they can be clearly seen in the illustrations. Each panel is enclosed in an iron housing of pillar form, and special precautions are taken in enclosing the control gear to exclude the dust effectively.

In individual driving it is even more essential than in group driving to provide means for rendering sudden overloads harmless, because in individual driving the motor has only power sufficient for the one machine that it drives, and no assistance is available from fly-wheels or countershaft pulleys, while the amount of kinetic energy stored in the moving parts of the machine and the motor is practically negligible. For instance, if a saw sticks, as it is always liable to do, the electric motor, in order to cope with the increased load, demands an abnormal amount of power from the mains. When this demand reaches a value likely to be injurious to the motor, the machine should be automatically stopped and the overload removed.

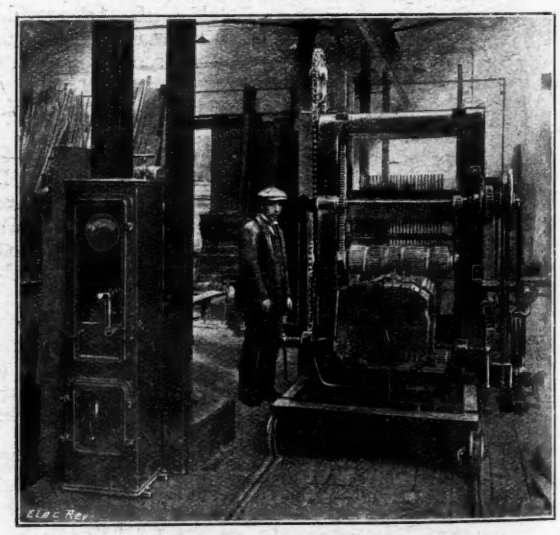
Automatic stopping under an overload is very trying to the control gear, and this is a point at which unsuitable controllers invariably fail and give trouble. The only satisfactory method of breaking a large overload current is to remove the actual break from the contacts of the starter altogether, and allow it to take place on a specially designed circuit-breaker, which should be fitted with very powerful magnetic blow-out and carbon circuit-breaking contacts.

In the "Conspede" controllers the circuit-breakers are made to be self-resetting. They have no handle, the whole operation being entirely automatic, and no further attention is required to restart the motor after being stopped by an overload than simply to reduce the load to safe dimensions, and start again in the ordinary way.

The circuit-breaker and starter are so interlocked that the first movement of the starter handle in the direction for starting causes the circuit-breaker to close automatically, and should an overload occur, either through too-rapid starting or from any other cause, it will reopen, and no effort on the part of the operator will avail to keep it closed until the load is lightened. Furthermore, having opened, the circuit-breaker will not close again until all the starting resistance has been re-inserted. A backward movement of the starter handle immediately stops the motor by opening the circuit-breaker, thereby making the contacts dead and protecting them against sparking and burning.

The panels have the great advantage of having only one handle, so that there is no possibility of the various operations being performed in improper sequence, as might occur if there were two or more handles, and the attendant were to operate them in incorrect order.

Each panel is provided with a stopping button at the side of the housing. These buttons are arranged to open the circuit-breaker, not to short-circuit the no-volt spools.



Log Frame, Saw of the Vertical Reciprocating Type, and Control Panel.

This feature makes the panels equally suitable for stopping the machines as for starting them, as the main circuit is never broken on the starter contacts. Any number of these buttons may be fitted round the various machines, thus placing them entirely under the control of the workmen, so that the machines can be stopped immediately on emergency from any position.

We understand that since this plant was installed, over six months ago, the Council's engineers have not had to replace a single fuse.

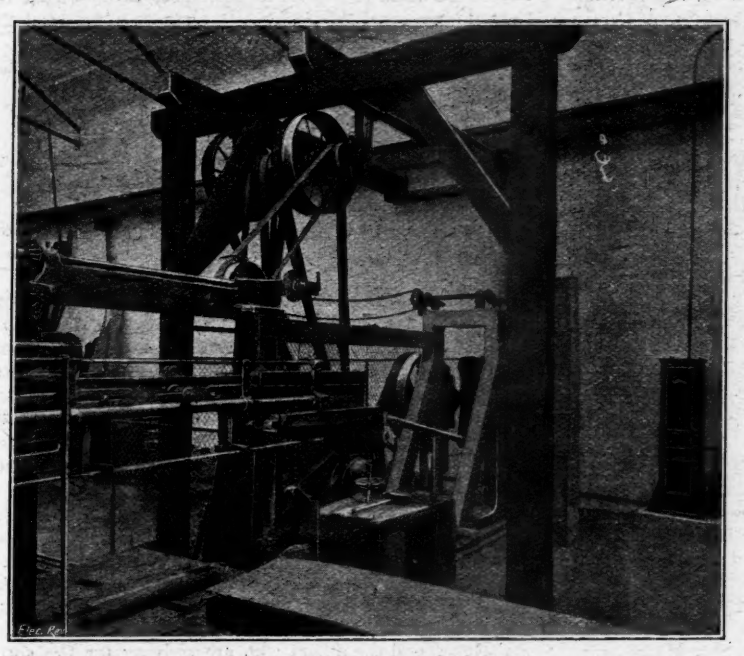
CORRESPONDENCE.

Letters received by us after 5 P.M. ON TUESDAY cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Screw Caps for Radiator Lamps.

Replying to Mr. W. H. Allen's letter in your issue of January 17th, respecting the trouble with radiator lamps and lampholders, I agree that the ordinary bayonet type is quite unsatisfactory. The screw holder would be an improvement, but for some reason this type of holder is not popular in this country.

I have experienced the burning away of the plungers of the holders, and also the contact plates of the lamps continually, as many radiators pass through this department in the course of a year. I think, however, I have overcome the difficulty by using "Mumps" holders, which lock the lamps in the holder. The porcelain body carrying the connections can be pressed forward to the lamp cap by means of a threaded ring to such an extent that the plunger sleeves engage with the lamp connections, thus forming a solid contact with the lamp. I have tested this form of lampholder since last September, and, in fact, all radiators now issued from this department are fitted with this particular type of holder. The holders cost nearly three times as much as the ordinary bayonet type, but the difference in cost is nothing compared with the saving in upkeep and satisfaction to the user.



HORIZONTAL RECIPROCATING LOG FRAME SAW AT LEA VALLEY MILLS.

S. E. Fedden, *Manager.*

Electricity Supply Department, Sheffield.

The Case of the Sub-Man.

I was very pleased to see your remarks *re* personalities, and feel sure the stale "old chestnuts" apply neither to the average present-day wireman nor to the sub-man. But what has struck me is the abhorrence which every sub-man has to membership of the Electrical Trades Union, and I trust you will let me say a word in defence of that society. Allow me, first of all, to welcome the movement to bring together our central station men. Of course I should prefer them to be members of our Union, but failing that, I hope a good strong organisation will be built up. The E.T.U. has always fought for the betterment of the conditions of the workers in our industry, no matter in what capacity, and if, up to now, no great success has been effected, that is because the men outside our ranks have not seen the benefits of organisation. Yet, at quite a large number of central stations in London alone, the E.T.U. has been the means of getting the men employed there fairly large increases, and, honestly, I do not like to see this biting the hand, which (if it does not feed) at any rate helps it. The men employed at the stations at Poplar, West Ham, Battersea, L.C.C., &c., have had their wages largely increased through the efforts of the E.T.U., and that, too, Mr. Editor, without a strike. The minute books of these various concerns will prove whether I speak the truth or not. How many of the men employed at these stations are members of the E.T.U.? I wonder! How many would join to help pay for the benefits they are receiving, and to help keep them up? I wonder! Too degrading, I suppose. I have yet to learn of any of these increases of 5s., 7s., and in some cases even more per week, being refused because they were the outcome of actions taken by the E.T.U.

So I trust the sub-man will not run down quite so much the Electrical Trades Union, the members of which are trying to better the conditions of those who are employed in this industry of ours—and as regards the sub-man, it requires some bettering. We have it on the word of Mr. Balfour, Mr. Lloyd George, the Bishops of Hereford and London, &c., and all the leading scientists of to-day, that the first charge upon *any* industry should be a living wage for *all* the persons employed in that industry. If any industry was not able to stand that, it should be swept away, as it was a menace and danger to the community. If this is true, and I, for one, should not care to disagree in this case with the eminent persons named, then half of these islands would be without light and power, apart from anything else. So, sub-men, organise, join this Association, try to improve your status, and get a living wage, but don't be snobs. In conclusion, I will relate a little incident, *which is absolutely true*, and happened only a few months ago.

At a large mill in Lancashire all the hands were in their Trade Unions, except the engine room staff (about a dozen in number). But in these days of industrial unrest no one is safe, and the men and women employed at this mill demanded that the engine room staff should join their Union—viz., the E.T.U. The fiat went forth from the manager that this should be so, and the engine room men were irate. A deputation met the manager and directors, and stated that *all* the men had conscientious objections to joining the E.T.U. Said the manager, "I have conscientious objections to *all* Trade Unions, but my conscience cannot stand in the way of my business. You will have to be like me—give your conscience a rest." They joined the Electrical Trades Union to a man, and their wages now are a bit more than they used to be, and their conscience is still resting.

So don't be snobs; we are not exactly mice, and even they have been known to help lions.

W. J. Webb.

London, W., *January 18th*, 1913.

Having read with considerable interest the many letters on central-station and sub-station engineers' grievances during the past few weeks, I am not at all surprised at the rather heated remarks. I myself being a central-station engineer agree with my fellow engineers and sub-station men. I might point out to Mr. Potter and his friends that the greater portion of the central-station engineers, &c., are men who have been through the shops of firms who manufacture the electrical and mechanical machinery used in central

stations. These men are the fit and proper persons to take charge because of their personal and practical knowledge of the machinery under their care. I understand that Mr. Potter is under the impression that wiremen are also fit and qualified men to enter upon central-station duties. I should like to point out that the wireman is a man used to wiring, erection of small motors, and occasional small factory work. As to central stations, his ideas are wrong. Where would the wireman be on a high-tension board? Another point is that central and sub-stations are in the first onset erected and fitted up by firms supplying the equipment and not by wiremen. As to the Association of Central-Station Shift Engineers, and Submen, &c., I quite agree that it is a thing much needed.

I will give the E.S.E.A. my support, and I hope that the secretary or a member will communicate with me as soon as possible. Mr. Potter need not be afraid that we shall upset the E.T.U., as I can assure him that the less we have to do with that society the better for all; we require trained men as engineers, not linemen or recruits. I consider that all engineers ought to pass an examination and hold a certificate as to qualifications.

Central-Station Engineer.

I have read with interest the recent letters *re* the association of submen. Why this should be necessary, I cannot say. Why not at once form an electrical association and include all grades who are connected with the running and maintenance of electrical plant? The submen are only a small section compared with the men who have charge of large plants in works, &c., where electrical power is used.

I have charge of plant for one of our leading newspapers, and there must be a large number in similar positions, and from experience I must say that to hold these positions requires highly skilled men and practical electricians; also there must be hundreds, if not thousands, of men in charge of plants in large works and business establishments in the British Isles. I know, personally, men who hold positions of this description whose salaries are from £3 to £6 per week, and I cannot say that it requires a college education to secure and keep these positions. A practical man is what masters require to-day. I have had my wiring experience with a firm of contractors, and very glad I am to know that I can do this class of work when required, and I cannot understand anyone classing himself an electrician who has not spent some time in wiring.

My point is this. The Electrical Trades Union only cater for the wiremen and armature winders, and their rules and rates of wages are for them alone; they have no rates for plant electricians, so, therefore, it is useless to join them. They may have a few in the society, but not many.

What I suggest to plant men (including submen) is to form an association or union, and not have it split into sections.

This correspondence was introduced in your paper some two years ago, and I think fell through owing to a certain section not wishing to come into contact with the other, and to make a successful start this time snobbishness must be left out.

I offered two years ago to do my share in Lancashire to form an association, and shall be pleased to do so now, and am sure should anyone write the editors of the Review we could get into touch with each other.

Unity is Strength.

I have read with much interest the correspondence in this paper with regard to the case of the sub-man, and it seems to me that we are getting very wide of the mark at which this correspondence was started. Now, it is nothing more or less than an argument as to who is the greater "gentleman," a "sub-man" or a "wireman." Speaking from experience, I can say there are as good "wiremen" with breeding and training as there are sub-men. I myself have been a much looked-down-upon wireman for several years, although I have had a good college training, and technical and practical experience in sub-stations and power stations of every description. I heartily endorse "Switchboard's" remarks that a man to make a good engineer is not necessarily the man of good birth and upbringing, but what a man is in himself. If "Motor-Generator" and "Booster" have had such an excellent training and experience, why do we find them in the position that presumably they are in? Why accept positions, in the first place, at such a low salary, when, with all their qualifications, they should be able to obtain better ones? If they accept responsible positions at a low salary to gain experience, and can afford to do so, why grumble? Also, if they have now obtained the experience they accepted the position to gain, why not leave and prove their worth by obtaining a more lucrative position elsewhere? If submen spent more time in trying to improve their positions, and themselves, by carrying out their duties conscientiously, and less time in running down people *they* consider to be their inferiors, perhaps they would find they would not have so much to complain about. Perhaps you think by the tone of this letter I am a wireman; I am not, but only trying to be fair to both sides. There is nothing to be ashamed of in being a wireman or a sub-man, as long as he proves himself to act as a gentleman. A good many so-called sub-station engineers would find it more advantageous if they knew a little more about wiring than they do now, and it would help them to understand their own positions a little better.

Old Sub-Man.

The Association of Electrical Station Engineers.

As acting chairman of the new Association of Electrical Station Engineers, I should like to make a few comments upon the correspondence that has been taking place in the Review between enthusiasts on the side of the Association, and others who have not the necessary qualifications for membership.

With regard to the latter I have nothing to say, except that one cannot expect persons of dissimilar interests to be capable of seeing "eye-to-eye" in the matter in question.

As to the former gentlemen, with whom this letter is concerned, I think it would be better now for them to cease from exchanging uncomplimentary references with the "other side," as this behaviour will only serve to lessen the dignity of the, as yet, embryo Association, and act as a deterrent to a large number of very desirable potential members.

So far as I am empowered to offer advice on the subject, it would appear to be better now that unofficial correspondence on the Association and its objects should cease, for the tone of the majority of the letters is not calculated to inspire that respect for the organisation to which it should be entitled from the very beginning. Neither is it fair to Mr. Ebben and the others who are striving for the success of our Association that they should be hampered in their efforts by any prejudices that may arise, due to the over-enthusiastic effusions of a few supporters, however well intentioned they may be.

I trust that my desires as above-mentioned will receive thoughtful consideration from those to whom they are directed, so that the already very numerous difficulties with which the promoters are beset may not be increased by a few irresponsible remarks, which, perhaps, after a little thought, might not have been given publicity.

In conclusion, may I suggest that the best work that can be done for the Association at the present moment, is to canvass and persuade as many as possible of our colleagues and professional friends and acquaintances to be present at the next open General Meeting, to be held on February 6th, at the same hour and place as before.

Turbo-Alternator.

Village Lighting.

When you introduce your readers to special articles in your valuable paper by a leaderette, and say that anything has been written at your request, one at least hopes to derive some useful information from a perusal of such matter, for the burden of keeping pace with all the weekly engineering journals is very considerable to busy men, so that when seven columns of your paper are devoted to a subject of great interest to the industry generally, it is disappointing to find such a lot of unreliable matter filling your paper, as occurs in your current issue.

You suggest that "the work of small supply stations is very attractive, and if generous terms are offered, there

should be no difficulty in getting first-class men to throw their whole energy in the business."

I should like to know how long the energy of this first-class man would be required in loading up a 10-KW. generating station, which, I presume, would be made up of second-hand plant, mains and buildings, if it is to cost only £500, and further, what would become of this fortunate individual's energy after, say, one year's work in a district of 1,000 inhabitants, and what his remuneration would then amount to? Mr. Wardale says that these men make as much money as chief assistants in towns with a population of 50,000 (I hope they make it honestly, for they would have much humble work to do), but do they?

I need not refer to many statements in the article which are as doubtfully correct as they are elementary, but surely, if the writer had any real knowledge of his subject, he would never have committed himself to the half-truths that he presumably picked up during his "fortnight's holiday" here and there, for on page 46 he describes a plant upon which he says no expense was spared, and must therefore have cost well over £1,000, having an output of 6,100 units per annum, and the total costs, including capital charges, work out at 1·8d. per unit.

Now, Sir, 6,100 units at 1·8d. amounts to £45 15s., and as the investor would expect at least £50 as interest on £1,000, where do the generous terms or the wages of the engineer come in? The whole thing is so absurd as to be valueless, and the article would have found a better place in a ½d. paper, notwithstanding the description of an undertaking with an output of 26,000 units, and an average cost of 3d. per unit, for while this may be accepted as reasonable, the article savours of so much second-hand information as to make the whole appear doubtful.

My only excuse for these few remarks is that, having carried out a number of installations in all sizes for such purposes as the writer describes, I know that many of his statements are unreliable, and that people contemplating such installations would do well to have more information before embarking upon even a 10-KW. equipment for public supply purposes.

Willesden.

January 14th, 1913.

I am obliged to you for an advance copy of "Willesden's" letter. If he will read either your leader or the article again, he will see how the man in charge finds work and wages to last him more than 12 months; at that particular place it has lasted over five years, and is still increasing—*i.e.*, general work in the district. Regarding the costs at Caldy coming out at £45 odd total, if he will read the article he will observe that it is stated distinctly that such a station cannot find a decent wage for a man, but other duties do, and this plant runs three days a week only. The figure of 1·8d. per unit is not the total cost including all capital costs, but including all *maintenance* costs, and I regret that the error slipped in.

Those elementary matters against which I have uttered warnings, are matters which have, in my experience, caused the failure of many such schemes. The lines which I recommend are those which have proved successful, and of this I have first-hand knowledge, carefully filed and tabulated, and am able to prove every statement. When "Willesden" can become courteous, I will discuss the matter with him.

W. T. Wardale.

I have read with great interest the article by your correspondent dealing with village lighting schemes, and I would like to mention that there are in Ireland several quite small village schemes which are working successfully. I myself carried out recently what I think is really the smallest public lighting scheme in the United Kingdom. This was the lighting of a village in Co. Fermanagh, having a population of only 250. At one end of the main street there was a disused corn mill with a plentiful supply of water and a good fall. I pointed out its advantages as a potential generating station to some of the principal residents, who immediately took the matter up and formed a company.

The total output of the plant is 6 KW., and it consists simply of a 10-B.H.P. turbine driving a Newton dynamo, the turbine being fitted with a governor; no attendant is required. The turbine is started up half an hour before lighting time, and left running all night. In order to reduce noise to a minimum the drive from the vertical shaft of the turbine to the dynamo shaft is worked with a quarter twist belt; this also had the advantage of keeping down initial expense, which is the main feature in schemes in this country. Current is supplied by meter at 6d. per unit. The plant has been working now for nearly 12 months, and has certainly paid its way handsomely.

J. S. Loughnan.

The Regulation of Street Traffic.

A policeman has been killed by a motor-'bus at Ludgate Circus. Research into London history teaches us that the last accident to a policeman at Ludgate Circus took place after the Battle of Parliament Hill, and was caused by the scythe on Queen Boadicea's chariot, which formed a part of the procession of the Roman Army when returning victorious from that bloody fight.

I may point out that Ludgate Circus was then no circus, but was laid out as such after that accident in order to render unnecessary the presence of a traffic controller. The circus dropped into desuetude on the introduction of four-wheeled vehicles. These had no lock or swivel, and were thus unsuitable for a circus. Having dropped out of use, although the reason has disappeared, yet our authorities, having no reason, cannot resuscitate the circus, but prefer to kill policemen. If, however, a semaphore signal is necessary, need it be a living one?

Some years ago a man named Faraday invented electricity. By means of this agent a man placed, say, 12 ft. above the middle of a street, say, at the foot of Ludgate Hill, could by means of press buttons direct the traffic by means of a wooden semaphore. To please our conservative authorities, it might be painted and shaped to resemble a policeman, and thus serve to secure, at once, safety and beauty, and harmonise with the conservative mind of unduly constituted authority. As you, Sir, know something about electricity, perhaps you would be so good as to acquaint Scotland Yard with the properties and powers of that substance, so that, before the sun grows cold and the ice age is again upon us, and Ludgate Hill becomes a glacier down which police-destroying vans will skid violently like Gadarene swine, that noble institution may awaken to the fact that we have moved since Thorneycroft's models passed so violently off the stage.

B.

British Laboratories for Electrical Goods.

The very interesting and valuable report to the B.O.T. by Mr. C. Hamilton Wickes—published in your issue of January 3rd—should not be allowed to pass into oblivion, hence my few comments thereon. I had expected abler writers to take the matter up.

Consider the case broadly: In the U.S.A. and Canada where these regulations are in force, there is an English-speaking population two and a-half times that of Britain, and their purchasing power of electrical commodities is at least proportionately large.

The underwriters' capital is to a very large extent British, but the technical staff which drafts the regulations, and which adjudicates on the merits of appliances submitted, is entirely American, and this staff can impose its veto on British-made goods destined for Canada.

Now, if U.S. officials will impose a tariff on other nations' goods in order to favour native manufacturers, it is a fair presumption that they will have a tendency to utilise their inspectorial veto to secure the same result. This is scarcely a fair or satisfactory position to Britishers, as we impose neither tariff nor veto on their goods which are imported here.

Really, in equity, we should have a similar testing laboratory mainly controlled by the insurance companies (underwriters) in Britain—the two working under identical rules, and the certificate of either being accepted by the other.

There appears no insurmountable reason why we should not do a larger export trade with the U.S.A. The tariffs they impose on electrical goods are heavy (about 45 per cent. *ad valorem*), but the protective influence of tariffs is in

general a diminishiug influence, and 45 per cent. tariff does not mean anything like a 45 per cent. handicap *now*. Speaking broadly, since that 45 per cent. duty was imposed, American manufacturing costs have been rising steadily in a greater ratio than our own as a result partly of the tariff, until perhaps to-day the handicap against us is very small comparatively, and unless the tariffs are again raised against us there is approaching a time when we will be able to send manufactured goods there quite as freely as they now send here.

This is my reason for regarding the present as an opportune time for establishing a testing and certifying laboratory in this country.

I think Mr. Wickes is in error in stating that each individual article must bear the stamp or label of the U.L.C. A moment's reflection must reveal its impracticability. Nor could each article be tested.

Fancy, say, arc lamps made in New Jersey and wanted in Boston. Must they all go to the Chicago Laboratory for test and label and travel an extra 1,600 miles in so doing? Apply the same idea to heavy machinery.

No. What probably happens (or is intended to happen as the rules have not yet obtained full sway) is that one appliance of a type is submitted for test and, if approved, is advertised in some recognised gazette or journal. The writer has very recently bought appliances—American made—and used them in a building in the States under close fire inspection, and they were not labelled or marked, nor was any mark obvious on hundreds of other appliances in use there. There were, however, notices in some cases which read "passed by the underwriters."

A testing authority in this country should be mainly under the control of insurance companies, so far as fire risk is concerned, and supported partly by manufacturing subscribers and others interested and by fees for testing and certifying as in the U.S.A.

As the insurance companies have evidently found the system of value in the States, they would doubtless find it an advantage here also.

The problem is—how to induce them to make a start here.

John Dugdill.

Failsworth, *January 20th*, 1913.

Electrical Trade in China.

I read your leading article, *re* China, and Mr. Williams's contribution in your edition of November 8th with considerable interest, but speaking with some experience of the electrical trade in China, I cannot do otherwise than feel that both your goodselves and Mr. Williams leave out two very essential features in your pæans of enthusiasm for the China trade.

Of course, the trade will come and you know from our many conversations that it would be hard to find anyone with a more firm belief in the future of the electrical trade in China than myself.

The two greatest difficulties to be contended with are, first, finance, and secondly, German competition.

In dealing with the question of finance, it is necessary to realise that if a firm is fortunate enough to secure a contract, it requires a plentiful supply of cash to carry it through.

The best terms it is possible to secure from Home manufacturers are for them to draw on the firm in China at so many days' sight, but in many cases cash against documents in London is insisted upon. Now on these terms you will see that in the former case the importer in China does not have to pay for his goods until they arrive or at some time during the usance of the manufacturer's bill. This means that the goods are financed for the voyage out, for which interest at 6 per cent. is charged.

The latter system of payment in London is very hard indeed on the importer, as he is then out of his money for about 60 days longer than he otherwise would be, while it saves only the 6 per cent. on the sight draft, so you will appreciate that if there is much cargo afloat being paid for in this manner, it is apt to leave the importer in China with his capital tied up.

The terms of payment obtainable from the Chinese have become very stringent, and the period required by them so long, that it is very difficult for a firm with a moderate capital to accept contracts at all.

The reason for these long credits it is more or less easy to find, and one need not look outside the offices of the huge Continental manufacturers in this country, who have found that the only way to beat down competition is to give such credit as no agent could possibly grant.

The wealthy Continental trusts, as they really are, being able to sell complete installations without going outside their group for any material whatever, are, of course, able to outbid our British manufacturers of whom not one is capable of supplying from his whole works everything that is necessary for a plant, and besides this, a nicely protected home market is reserved for them, and a brisk healthy market is presented to them for nothing in our own island, so that there is a very large playground for our Continental friends to enjoy. Our own manufacturers, who are too numerous, have to fight for their own market, and, speaking electrically, are, with one or two exceptions, such as the great cable companies and a large Lancashire house, hard up and have no money for pushing and creating a practically new market; a glance through the electrical share quotations in your own journal clearly indicates the state of the electrical manufacturing concerns in Great Britain.

Now, as to the competition, I have culled from the *Official Gazette* of the Shanghai municipality the last three examples: In May last, 16 60-B.H.P. three-phase motors were purchased; the results were—British, £756, £636, £633; German, A.E.G., £573; Siemens, £492.

The next tender was called for in September for 18 motors. British prices were—£1,133, £1,166, £938; American, £1,083; German, A.E.G., £906; Siemens, £790. In October tenders for 13 motors brought out the following: British, £1,383, £1,345, £1,327, £1,218, £1,232; American, £1,320; German, A.E.G., £1,097; Siemens, £1,047. These figures will give you a good idea as to the competition to be faced by British manufacturers in China.

Why our British prices are so high, I do not know, unless they are due to the competition in our own country, the number of small companies which each have their directors, offices, staff, &c., and which could be run so much cheaper if they were amalgamated.

Besides the difficulties I have already outlined, it is a cruel blow to we British representatives when our own Government give our strongest competitors their patronage. It is not difficult to imagine the advertisement which will no doubt be used to the fullest extent by our German friends, by their being able to say that even the British Government gives us work, so our material must be better than that made in their own country.

Edgcumbe Brighten.

Shanghai, *December 27th*, 1912.

Small Power Installations.

May I suggest that it would be eminently interesting to station engineers and other power users to hear representative views on the respective merits of the Marshall economic steam power plant, as compared with those of suction gas and oil, for small power units?

Station Engineer.

Siemens Rifle Club Dance.—Although a comparatively new institution, the Siemens Dalston Rifle Club, is thoroughly appreciated by both male and female members of the staff. In connection with this club a dance and social was held on Friday evening at Northampton House, Highbury, which was specially engaged for the purpose, and a party of between 100 and 150 thoroughly enjoyed their first social gathering under the auspices of the shooting men. The dancing hall, refreshment room and card room were illuminated with "Wotan" lamps in Holophane reflectors. A set of 14 dances figured on the programme, with four extras. The proceedings commenced at 7 o'clock and finished shortly after midnight—the whole of the time being well occupied. In the social section of the entertainment, Messrs. A. and B. McFarlane, Hicks, Bardell and Higgins all contributed interesting items. Mr. Hayden (the secretary of the club) acted as M.C. This "sighting shot" was restricted to members of the Dalston staff.

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

New Calculating Device.

We have received from MR. H. W. BROWN, of 169, Cathall Road, Leytonstone, N.E., a novel device for calculating the combined resistance of two or more shunt circuits, which we illustrate herewith. The mode of operation is as follows:—Take as an example two circuits, one of 75 watts and the other of 25 watts. The thread hanging from A would be stretched across to 75 on the right-hand side of the scale, and that from B to 25 on the left-hand side. Where these two threads cross, the combined resistance of the two circuits can be read off by means of the horizontal lines. It will be seen that the range of the device can be extended, and that the percentage of current in each circuit could be read off by means of the vertical lines.

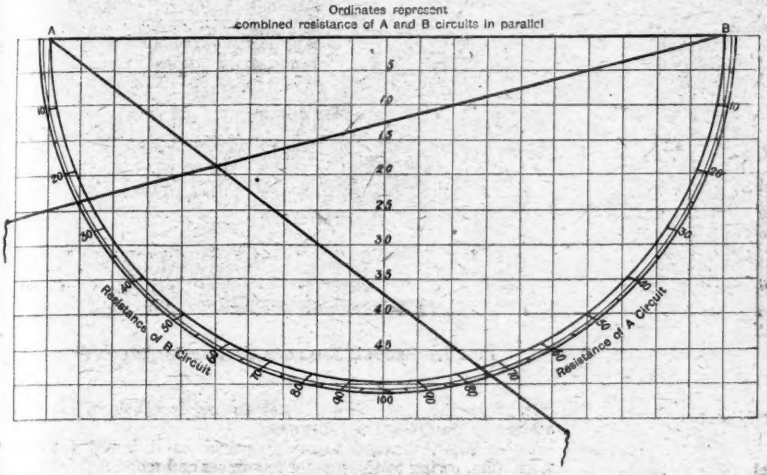


FIG. 1.—DEVICE FOR CALCULATING THE JOINT RESISTANCE OF TWO CIRCUITS IN PARALLEL.

It is easy to see how the device is constructed; the theory of its operation may afford an interesting problem for readers who are not mathematicians—the latter will see it at a glance.

Carron Cooking and Heating Appliances.

THE CARRON CO., of Carron, Stirlingshire, have recently issued a well-illustrated booklet dealing with their electrical cooking and heating appliances, consisting of cooking ranges, grillers, hotplates,

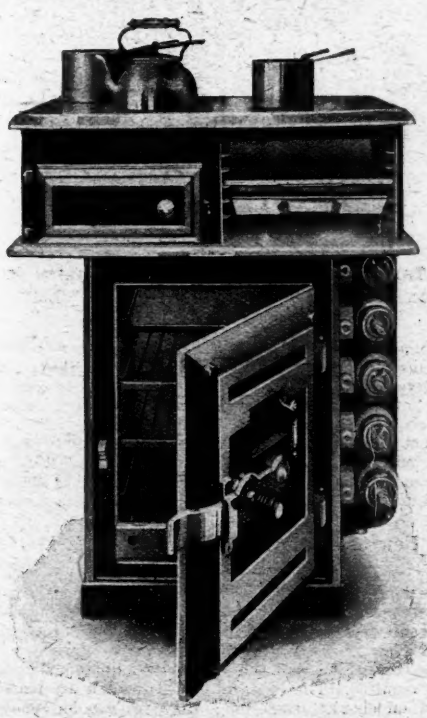


FIG. 2.—CARRON ELECTRIC COOKING RANGE.

steaming ovens, urns, and a variety of designs of luminous radiators and convectors. The company has a reputation of over 150 years' standing in iron manufacturing, and it is a matter for congratulation that its extended knowledge of cooking and heating apparatus is now being applied with a view to furthering the latest development in connection with such apparatus, viz:—Electric cooking and heating.

While space does not permit us to deal at length with the firm's electrical productions, we illustrate one or two typical pieces of apparatus produced by it. Thus fig. 2 is an electric range, consisting of an oven with a grill, hot closet, two circular boiling plates and a warming plate mounted over it. The oven and hot closet are white porcelain enamelled inside, and the former is fitted with removable hangers and grid shelves and provided with an inspection window in the door to enable the progress of the cooking to be watched. The cooking temperature can also be ascertained without opening the door by means of a thermometer provided, and the heating elements can easily be replaced *in situ*. The oven is rated at 3,000 watts, the grill at 1,300 watts, and each boiling plate at 800 watts.

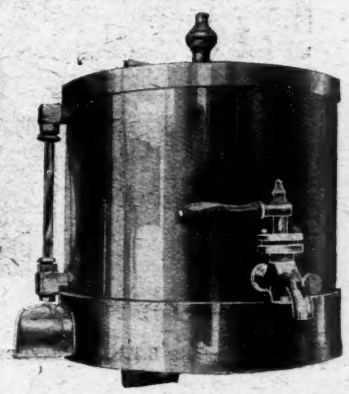


FIG. 3.—ELECTRIC URN.

The company also makes a more expensive combination cooking range, consisting of an oven—with a full-sized inner glass oven door, to allow of inspection while cooking, without heat loss—and beside it a double grill and toaster with a hot closet beneath, while on the top of the range are hot-plates for boiling, &c. Three heats are provided, and, in connection with the switches, two plugs and sockets for connecting to the main cable.

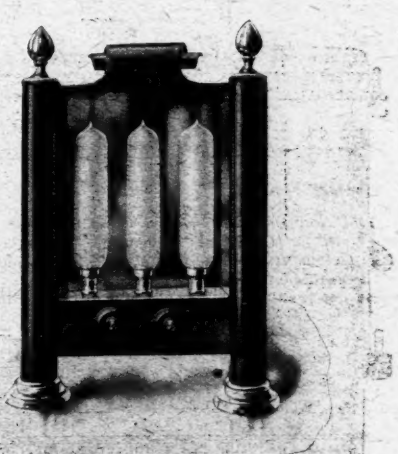


FIG. 4.—CARRON THREE-LAMP RADIATOR.

We further illustrate in fig. 3 a brass and copper urn, electrically heated, and suitable for restaurant use. This is claimed to boil 2 gals. of water in 22 min., the minimum heat being obtained on 1,500 watts and the maximum on 3,000 watts. The company has a number of registered radiator designs in cast-iron, brass or copper, one of which, built in black, copper or brass finish and for two, three or four lamps, we illustrate in fig. 4.

In the case of the convector heaters, built for any number of heating elements up to six, the latter are guaranteed for two years.

A Single-Phase Prepayment Watt-Hour Meter.

THE BRITISH THOMSON-HOUSTON CO., of Rugby, are introducing an A.C. prepayment watt-hour meter, which is claimed to represent a distinct advance in the design of watt-hour meters of the induction type. It is manufactured in the 3 and 5-ampere sizes for any voltage required, and so that the rate of payment can be easily

changed without recalibrating the instrument or taking the dial to pieces.

The mechanism and the meter element are mounted in a cast-iron case and are protected by a dust-proof cover, and a window is fitted in the latter, through which the dial and coin indicator may be read. The indicator records the number of coins standing to

FIG. 5.—THE B.T.H. PREPAYMENT METER.

the credit of the consumer and the meter dial registers the total number of units consumed. The prepayment mechanism consists of a main control switch of the single-pole, quick-break, knife-blade type, which is closed mechanically when a coin is paid into the meter. This switch is held closed so long as there is any current remaining to the credit of the consumer, but opens automatically when the coin indicator reaches zero. The coin box is capable of containing 120 pennies and can easily be

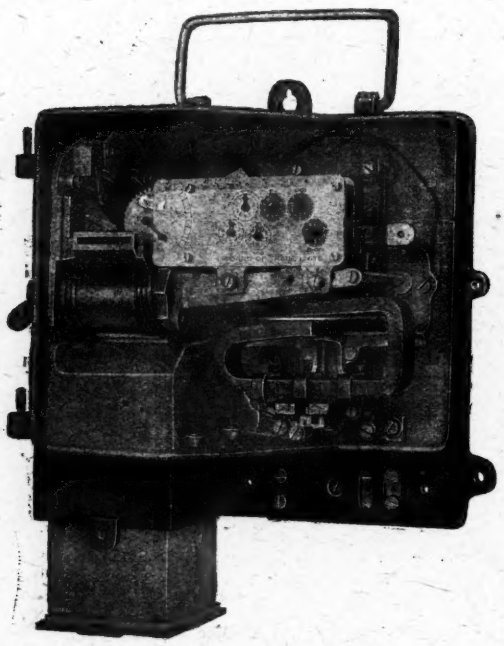


FIG. 6.—B.T.H. PREPAYMENT METER, OPEN.

emptied by withdrawing the till, which is secured either by a seal or padlock, as desired. A separate cover protects the terminal box, enabling this portion to be sealed independently of the other parts of the meter.

In operating the meter, the coin handle is turned to the right, the coin inserted, and the handle turned back again; this closes the switch and the coin indicator advances one division, and so on for each coin inserted, while the indicator travels back towards zero as current is consumed, the switch opening when zero is reached.

Brooke Emergency Ship-Lighting Set.

Our illustration, fig. 7, shows a 20-KW. generating set by MESSRS. J. W. BROOKE & CO., LTD., of Lowestoft, supplied for emergency ship lighting and deck lighting on board a new vessel being built for the Union Steamship Co. of New Zealand.

The engine is a 28-H.P. nominal four-cylinder motor, with dual magneto ignition and centrifugal governor, which controls the speed from no load to full load within 1½ per cent. variation.

The engine is coupled to a Siemens compound-wound dynamo, producing current at 110 volts.

The plant is self-contained, with its own radiator; this is in order that it will not be necessary in emergency to have to suck

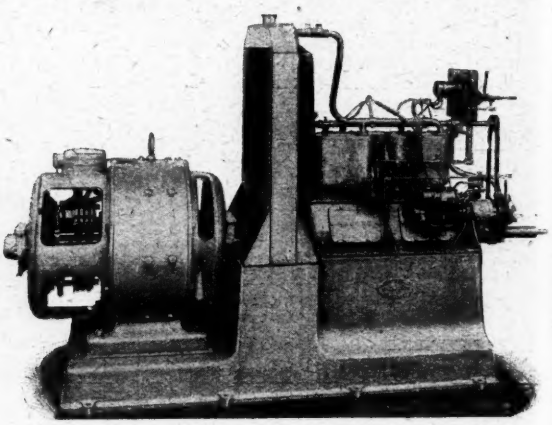


FIG. 7.—BROOKE EMERGENCY SHIP-LIGHTING SET.

water from the sea level, which, of course, is often, in big ships, below the limit of suction distance.

The engine is arranged to run on petrol, as it is very preferable to paraffin, owing to the greater handiness and more rapid starting up and greater reliability.

The "Globus" Lamp.

A new pattern of glow lamp has been introduced by the "GLOBUS" BELEUCHTUNG- UND HEIZUNGS-INDUSTRIE G.M.B.H., of Fontane Promenade No. 14, Berlin S. 59. It is intended especially for signs and illuminations, and is illustrated in fig. 8; it is made for 14 volts, so that on 110 volts eight lamps can be run in series, and is rated at 1 watt per candle, although the filament is of carbon, the light being concentrated along the axis of the lamp as shown in fig. 9. This effect is not obtained by silvering the back of the bulb, but by the special form of the bulb and the central collector, so that a 2-C.P. lamp is made to give 8 C.P. along

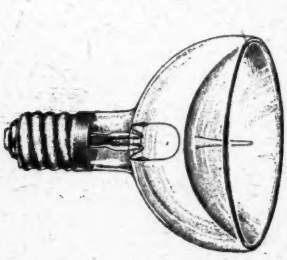


FIG. 8.—THE "GLOBUS" SIGN LAMP.

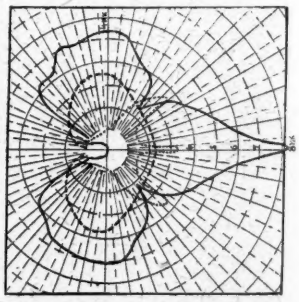


FIG. 9.—ILLUMINATION CURVE OF "GLOBUS" LAMP.

the axis in a conical pencil of light. The figure shows (dotted) the ordinary shape of the illumination curve, as well as the special shape of the curve of the "Globus" lamp, whence it will be seen that the usual type of incandescent lamp is ill adapted for end-on illumination. Carbon filaments are used because, unlike metallic filaments, they do not take an excessive rush of current at the moment of switching on, and it is claimed that in the case of flashing signs this enables the carbon filament to be as economical as the tungsten. The form of the bulb, it is said, renders it almost unbreakable.

New G.E.C. Ironclad Reversing Switches.

For the control of small motors, particularly such as are used in connection with portable tools, the GENERAL ELECTRIC CO., LTD., have recently devised appropriate switchgear which is an improvement over that now in use. The new "push-on" and "push-off" switch is specially recommended for attaching to portable electric tools, and the like, where a quick make-and-break action is required. The contacts of this switch are massive, and supported on ebonite insulation; they are run on small wheels which reduce friction to a minimum and thus give a free-and-easy action to the "on" or "off" movement. The case is of aluminium. This switch is suitable for any current up to 8 amperes, 110 volts. The dimensions (overall) are 7½ in. × 3½ in. × 2½ in. The small drum type reversing switch (illustrated in fig. 10) has also been designed by the company especially for use with Witton-Kramer tools. This switch is constructed with a portable handle; its glands are

arranged to serve as efficient cord grips to hold securely the indicator cables. The fingers are renewable. The revolving drum is of cast-iron, and the entire switch is rainproof; it is suitable

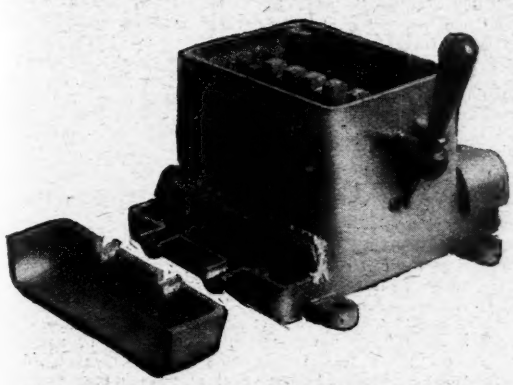


FIG. 10.—G.E.C. DRUM-TYPE REVERSING SWITCH.

for any motor up to 2 H.P. at 240 volts. Its dimensions are 9¾ in. × 8¼ in. × 5¼ in.

"Tricity" Ship Heaters.

THE BRITISH ELECTRIC TRANSFORMER CO., LTD., of Hayes, are introducing a type of non-luminous low-temperature heater, taking very small power, for ship heating.

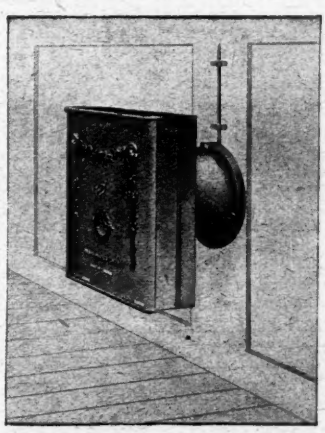


FIG. 11.—BULKHEAD TYPE "TRICITY" METER.

The heater unit consists of a strong, heavily webbed, cast-iron grid, containing the Berry patent element, giving an effective heating surface of about 4½ sq. ft. This grid breaks up the air

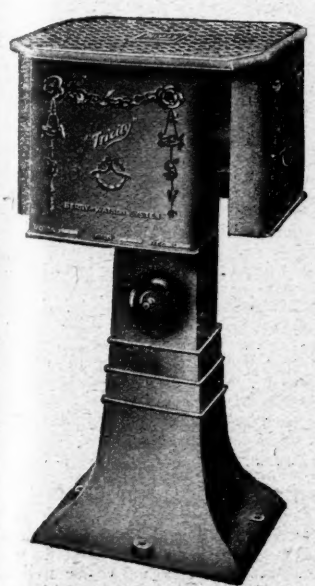


FIG. 12.—MULTIPLE UNIT HEATER.

FIG. 13.—PEDESTAL HEATER.

particles to give the best heating of the air by convection. The grids attain a temperature of about 500° F. in 15 to 20 minutes, with a consumption of 250 watts, which is the wattage consumption of a single lamp of a four-light luminous radiator, and the apparatus is covered by an ornamental cover or guard, to form the funnel for the heated air. The heaters are made for all standard voltages from 100 to 250, and can be supplied, as illustrated, either bulkhead pedestal or multiple-unit pattern, and suitable for any form of wiring.

When it is desired to use them in saloons, they can be installed in groups under settees, a special "settee" type 750-watt heater being supplied, with an overall height of only 8 in.

LEGAL.

ELLIS *v.* THE OSRAM LAMP WORKS, LTD.

BY this action, which was tried by Mr. Justice Neville in the Chancery Division last week, the plaintiff, as lessee of Poplar House, Hammersmith, claimed an injunction and damages in respect of an alleged nuisance of noise, smell, and vibration caused by the defendants' works, which were adjacent.

From the opening statement of MR. CAVENAGH, who appeared for the plaintiffs, it appeared that negotiations for a tenancy of the house were entered into in 1908 with the Robertson Electric Lamp Co., who were the then owners, and who were also the predecessors in title of the defendant company. The rent was to be a weekly one, increasing from year to year for three years; but subsequently an arrangement was come to for a fixed weekly rent on a three years' agreement. Bad smells emanated from the defendants' works, accompanied by loud explosions, which had recently become so bad that the plaintiff had had to vacate the premises, and damages were claimed in respect of both that and also in respect of damage alleged to have been done to some outbuildings used for storing theatrical scenery.

Evidence was called in support of the plaintiff's case, and MR. JENKIN, K.C., for the defence, contended that, on the true construction of the agreement, the tenancy was merely a weekly one, and, further, that there had been no appreciable nuisance.

Evidence was called for the defence to prove that, though some nuisance did exist in the years 1908 and 1909, new plant was installed, and since 1910 any nuisance that there might have been had ceased to exist.

His LORDSHIP, in giving judgment, said that the conclusion he came to upon the evidence was that there was no such nuisance as to render the plaintiff's house uninhabitable, and as it was upon that the case for damages was principally based, the action must fail. There appeared, however, to be some damage in respect of the outbuildings, but it was small, and he would estimate it at £7. The costs of the action would be the defendants', but a counterclaim raised by them would be dismissed without costs.

GRAETZIN LAMP AGENCY.

MR. JUSTICE SCRUTTON was occupied during January 15th, 16th 17th and 20th in the Commercial Court of King's Bench, in hearing an action brought by Mr. Bernard Braunstein, trading as Jaques, Braunstein & Co., of Carthusian Street, E.C., against Mr. Max Graetz, trading in Berlin as Ehric & Graetz, manufacturers of electric appliances, to recover damages for breach of agreement of agency for the sale in this country of the defendant's electric lamps.

MR. DUKE, K.C., appearing for the plaintiff, said, in the course of his opening address, that the plaintiff was a gentleman who had been engaged for many years in London in the sale of gas fittings and fittings for electric lighting. The defendant was a manufacturer of electric light fittings in Germany, and he entered into an agreement with the plaintiff, under which he (plaintiff) was to have the exclusive agency for the sale of the defendant's goods in this country for a period of years. It was for a breach of that agreement that the plaintiff claimed damages. What had happened was that the defendant had himself set up in business in this country by forming a limited company to carry on the business, of which the plaintiff was to have the sole agency. At the beginning of 1907 an agreement was entered into, under which plaintiff for a period of six years was to have the exclusive agency for the sale of the defendant's electric lamps. The business was successful and a large trade was done. In December, 1908, the defendant, who had become patentee of a new metal-filament lamp called the Graetzin lamp, approached the plaintiff with a view to his taking up the agency for the sale of that lamp. An agreement was entered into under which, if the plaintiff was able to sell in this country £5,000 worth of the Graetzin lamps within a year from the time he received the final samples, he should have the exclusive agency for two years, and if in the course of the second year he was able to make sales to the extent of £10,000, he was to have the exclusive right for a further period of five years. Under the events which happened the plaintiff became entitled to an exclusive right for the term of two years and an additional five years which began at the end of the first period. The first two years would expire in June, 1911, and the additional five years would therefore carry the agency on until June, 1916. The events which put an end to the agency occurred in the summer of last

year. In the electric lamp business it was necessary to be in the market with the goods in the spring of the year, but the defendants had not their samples ready in time. To give plaintiff a fair prospect of doing a substantial business in the following winter, he ought to have had the samples in February, as the custom was to take the orders in the spring and deliver in the autumn. Agreements were made by the plaintiff with other firms, but while they were given the right to sell, they did not interfere with his business. It was arranged with Krupka & Jacoby that they should take up an agency, but their business did not come up to the minimum, and subsequently the defendant arranged with them that they should form an English company to carry on the whole of the defendant's business in England, including the business then being carried on by the plaintiff, and that they should have the sole agency for the sale of the defendant's electric lamps. In August of last year the defendant wrote to the plaintiff a letter purporting to cancel the plaintiff's agency, and informing him of the agreement with Krupka & Jacoby, and requesting him to cease taking orders.

MR. JUSTICE SCRUTTON said that as there was no jury, he would like to hear what the defence was before the plaintiff's witnesses were called, in order that he might better understand the bearing of the evidence.

MR. ATKIN, K.C., appearing for the defendant, said that, in the first place, he contended that there had been no breach of the agreement, and that the plaintiff had not duly performed all the conditions under the agreement. The agreement with Krupka & Jacoby was no breach of the agreement between the plaintiff and the defendant, and the defendant had always been ready and willing to employ the plaintiff.

MR. BERNARD BRAUNSTEIN, the plaintiff, was then called, and gave evidence generally bearing out his counsel's opening. He said that he had long acted as an agent in this country for the sale of foreign gas and electric fittings. Until the end of 1905 he had been acting for Spinn & Sohn, and had a considerable connection amongst the purchasers of gas and electric goods. In 1906 he was introduced to the defendant firm, and at that time he was doing business to the amount of 100,000 marks a year. In 1908 he was approached by Graetz with regard to putting an electric lamp upon the market. He went to Berlin and entered into an agreement with defendant, and as the result of a discussion, he subsequently negotiated a sub-agreement with the Welsbach Co. for the sale of the lamps. That was in March, 1910. The agreement continued for two seasons, and was very successful. He did not receive the prices and samples from the defendant until it was too late to take advantage of the season. All business was practically done before April, and he did not get his prices until May. The firms with which he dealt complained of the price because Jacoby's were selling lower. When he was in Berlin he had pointed out to the defendant that improvements in the lamp were necessary.

MR. DUKE: What do you value the business at—what have you lost by the breach of agreement?—I made 100,000 marks in the first year, and in the second year I made four times as much.

Witness, continuing, said that the sale of electric lamps was an increasing quantity, because they had been much improved, and they were 25 per cent. cheaper than they were six years ago. The current was cheaper also, with the result that, while gas lighting was going down, electric lighting was going up.

Asked as to the increase in the sale of the metallic-filament lamps, the witness said that, on the basis of the contract, he would have been able to obtain from £3,000 to £4,000 a year.

In cross-examination by MR. ATKIN, K.C., for the defence, witness said that, in respect of the electric lamp agency, the agreement stipulated that he was to introduce the goods into England at his own expense. The business was not a very easy one to introduce at the beginning, as others had possession of the market. The only commission earned by him on his electric agreement was upon the Welsbach orders. In 1912 he was not able to sell, because he could not get the prices from the defendant.

Re-examined: He found from the invoices that five times as many unstamped lamps were sold as those which were stamped, because the unstamped, although the same article, could be sold at a cheaper rate.

This was the plaintiff's case.

MR. ATKIN submitted that there had been no breach of agreement. The plaintiff soon found that he was unable to do much unless he could get the lamp known on the market, and hence he was willing to fall in with the suggestion of the defendants to let Krupka & Jacoby take up the business, and the agreement with that firm was negotiated by plaintiff. If was a term of the arrangement that his commission should be reduced from 3½ to 2½ per cent.

Continuing his address on Jan. 16th, Counsel submitted that there had been no breach of agreement, because the only arrangements entered into were those with Krupka & Jacoby, to which Mr. Braunstein had consented. Messrs. Graetz, he said, were entitled to sell goods to Krupka before the agreement, and all that had happened was that they had continued to sell goods as before. There had been no breach in relation to the payment of commission, as the plaintiff alleged, because at the time the writ was issued no commission was due.

His LORDSHIP said it occurred to him as a possibility that there had not been a final repudiation of the agreement, and that the plaintiff had jumped at a conclusion when he issued the writ. In that case there might be another action arising, to determine the position of the parties. When the evidence was over he would formally ask whether it was desired to amend, as "two bites at a cherry" in an action of this description seemed to be rather undesirable

MR. MAX SCHULTZ, general manager to Ehric & Graetz, in Berlin, was called, and gave evidence as to the making of the contract with Krupka & Jacoby, and said that when he came to London to see them in 1910 in connection with closing the agreement for the contract, the plaintiff complained about the price of the lamps being too high for him to compete successfully with others. He did not complain of not having received price lists. He (witness) came over to this country again in January, 1912, and saw Mr. Jacoby and Mr. Braunstein, when they discussed the question of the cost of the lamps. Competition was very severe at that time owing to the German Incandescent Co. making a reduction in price. That was, he thought, at the beginning of 1911, and the English manufacturers soon followed by making reductions also.

In cross-examination, Witness said that he assisted in making agreements with Mr. Braunstein in reference to gas as well as electric fittings, and prices were always discussed when they met. The prices submitted to Krupka & Jacoby were not the same as those submitted to the other accepted firms. They were somewhat lower.

Had the firm special prices for the non-stamped metallic-filament lamps?—No difference was made. The supply of non-stamped lamps to England was smaller than that of the stamped lamps. There was no difference between the stamped and unstamped lamps. Cheaper prices were first quoted to Krupka & Jacoby about November, 1912. Reductions had been made to Mr. Braunstein in some instances.

Witness was further closely cross-examined as to the reduction in price which the defendants had made, and he would not deny that a reduction of 10 per cent. in the price of 16 to 50-C.P. lamps had been made to Lott, Abbott & Co. some time before the plaintiff was informed of the reduction.

In re-examination, Witness said that he was a director of the Graetzine Light, Ltd., which dealt entirely with gas, the object of the company being to take over the British business in gas lighting as carried on by Messrs. Graetz. It was proposed that the Krupka and Jacoby Co., Ltd., should deal with the electric lighting.

MR. HORACE BARRETT, a member of the firm of solicitors acting for the defendant and for Krupka & Jacoby, gave evidence of the circumstances under which the agreements with Ehric & Graetz were drawn up, and as to the steps taken for the purpose of forming the two companies.

MR. MAX GRAETZ, the defendant, said he carried on business in Berlin in incandescent lamps, high-pressure lamps, and oil lamps under the title of Ehric & Graetz. It was a very large business, and he employed thousands of hands. The plaintiff had been his agent for some years, and from time to time he came to Berlin to discuss business. In April, 1912, there was a discussion with regard to gas lamps, and witness at that time told him that his services as agent for gas would not be continued. Nothing had been done to terminate his agency for electric lamps.

On the case being resumed on Friday, January 17th, MR. BARRETT, the solicitor, was recalled for cross-examination by MR. DUKE. He said that premises were taken on behalf of the company at 26 to 36, Chapter Street, Westminster, and it was there that the whole of the English business was to be done. They were held in trust for Graetz in the name of Jacoby. The premises had been reconstructed, the money for which had been provided by Messrs. Ehric & Graetz under the name of Krupka & Jacoby.

MR. DUKE: Was the only object in forming the two companies in England to be wide awake in case of any alleged infringement of patent?—So far as Krupka & Jacoby were concerned, that was the primary object. In substance, the £5,000 capital and £8,000 debentures in the company were to be held in trust for Ehric & Graetz, but ultimately for the British Electric Light Co.

MR. MAX GRAETZ, the defendant, was recalled and cross-examined by MR. DUKE. He said that during the past six months he had not been doing more business than in former years. The business had not all been done through Messrs. Krupka & Jacoby. Mr. Braunstein was still his agent for electric lamps and fittings, and would continue in that position during the current year.

Has any action been brought against you for infringement of patent?—Yes, by the General Electric Co. They threatened an action against us by letter.

Did you send that letter on to Mr. Braunstein?—No. That was at a time when Mr. Braunstein had ceased to answer us. It was after August 6th, 1912. The first threat reached us in October or November of that year.

Can you tell why you did not communicate to Mr. Braunstein the arrangement you were making with Krupka & Jacoby during the first part of 1912?—The main reason was that the profit which Mr. Braunstein derived from the gas business was as much as the salary of Krupka & Jacoby.

Is the salary of Krupka & Jacoby £1,200 a year each?—It was something more than that—25,000 marks.

Continuing, witness said that the business done through Mr. Braunstein had dropped during recent years, and in dealing with the gas themselves they were able to raise the business again. He had had experience which told him that it was not wise for one company to deal with both gas and electric lighting, and therefore it had been determined to form two companies.

MR. OSCAR KRUPKA, a member of the firm of Krupka & Jacoby, Ltd., gave evidence as to the agreement between the company and the defendant, and said that he was a large dealer in electric lamps.

MR. DUKE: Has any action been brought against you for infringement of patents?—Yes, by the Osram Lamp Co. The action was brought, said the witness, against him personally, as well as against Krupka & Jacoby, Ltd. He did not consider that his lamp was similar to the Z lamp. The writ in the action was issued in

November of last year. The Graetzin lamps bearing trade-marks were 75 per cent. of the whole amount received.

DR. J. DUNCIER, a German advocate, was called to prove the German law in relation to the termination of an agency. He said that in German law an agent had no actionable right to work, but was confined to his claim for commission. The German law did not recognise a sole agency. In view of Patent disputes, the principal would stop an agency, because the German law regarded patent infringement as a criminal offence, and the principal might be subjected to very heavy damages. If an agent turned his business into a company, of which he was to be managing director, the employé could not interfere, but if some other person was appointed manager, the position might be different.

On the case being resumed on Monday, further evidence was given as to the German law relating to agreements.

MR. ATKIN, K.C., addressed the Court upon the evidence, dealing at length with the terms of the contract, and the interpretation put upon them by German law and by English law. In either case, he argued, there had been no breach. As to the damages, assuming that the contract had been broken, his Lordship, in considering the amount, would have to take into account the fact that Mr. Braunstein had admitted that he could not get the goods at a price which would suit the customers. Further, he could not forecast the result of the patent actions, because if the defendant's goods were an infringement of patent, the sale would be destroyed, and the business taken out of the hands of the defendant. The agency would thus come to an end.

MR. DUKE, K.C., for the plaintiff, contended that the agreement was governed by the law of the place where it was carried out, which was England. On the question of damages, counsel said that the business of the defendant was a very valuable one, and the suggestion that they were frightened about patentees bringing actions was "all moonshine." The trade in electric lighting was increasing from year to year, and the privileges purporting to be secured by the agreement of 1908 were increasingly valuable.

His LORDSHIP reserved judgment.

ELECTRICITY IN MINES.—APPEAL.

JUDGMENT was delivered on Friday by the Lord Chief Justice and Justices Coleridge and Rowlatt in the King's Bench Divisional Court, in the appeal by Mr. John Atkinson, an Inspector of Mines, against a decision of the Gateshead Magistrates, who had declined to convict Mr. H. M. Imrie, manager of the Chopwell Colliery, near Gateshead, for an alleged offence under the Coal Mines Regulation Act (Electricity Rules).

The charge was that Mr. Imrie had contravened the rules by not having an electric switch-box earthed, and the Magistrates refused to convict, holding that no offence had been committed. It was pointed out that the whole question was whether earthing of the switch-box was construction or installation. Mr. Imrie's contention was that it was construction, while the Inspector argued to the contrary. If it was construction then the rules did not apply, because the apparatus had been constructed before 1911, and they applied to apparatus erected after that year. It was stated that the switch-box in question was for controlling a portable electric motor, which worked a conveyor for carrying coal, and it was alleged that the box was not earthed to the insulation system. On May 3rd, 1912, the box was out of order, and a workman, touching it, received a shock which proved fatal. Counsel argued that, if the box had been earthed, this might not have happened.

The Court now dismissed the appeal, with costs.

The LORD CHIEF JUSTICE said he had read the judgment of Mr. Justice Coleridge, and agreed to it, so there was very little he could add. The point for decision was whether the apparatus in question came within the exemption in Provision 20 (B) of the Act, and whether earthing it would be construction or installation. The two things ran very close together, so that the point was rather difficult to decide. He had looked at the description of the apparatus which was in use before June, 1911, and came to the conclusion that it came within the meaning of "construction," and he, therefore, could not come to any other conclusion than that arrived at by the Justices, viz., that no offence had been committed by the respondent.

MR. JUSTICE COLERIDGE said the case for the appellant was that a switch-box was not earthed in connection with the insulation system in contravention of Sec. 8, Sub-Sec. 8, of the Coal Mines Regulation Act (electricity rules). Respondent claimed exemption under Sec. 20, Sub-Sec. 6, which excepted from the provisions of Sec. 8 any apparatus which was in use prior to June, 1911, so constructed or adapted so as to comply with the requirements in vogue relating to the construction of electrical apparatus in mines before that date. If earthing by connection with an earthing system meant construction of electrical apparatus, the exemption applied; otherwise it did not. In order to earth a switch-box it had been found necessary to connect it with another cable in addition to the one already connected with it. Was that an alteration or addition or construction of electrical apparatus? Apparatus, according to the definition clause, included all machines and fittings in which conductors were used, or in which they formed part. A switchbox was, therefore, apparatus. For the earthing of a switchbox a different apparatus was necessary. The Magistrates, after viewing the apparatus, came to the conclusion that to connect one with the other you must reconstruct. It was said for the appellant that if you add you do not reconstruct but install. If by adding to the apparatus the addition formed part of the whole, then he came to the conclusion that you construct, and to construct was to put parts of the whole together according to some regular and definite plan. The added cable would be, in his opinion, part of the whole electrical apparatus, and therefore part of a construction, and as construction brought the apparatus within the exemption, there could be no offence, seeing that the switchbox was constructed before June, 1911.

MR. JUSTICE ROWLATT agreed, and the appeal was dismissed with costs, as before stated.

TRAMWAY ACCIDENT CLAIMS.

IN an action against the Dumbarton Burgh and County Tramways Co., Ltd., Dumbarton, for personal injuries, a jury in the Court of Session awarded a widow £50.

A jury under Lord Skerrington in the Court of Session last week, also awarded £200 damages to a grocer in respect of injuries sustained by his child through being knocked down by an Edinburgh cable car. The pursuer attributed fault to the defenders in respect that the driver of the car failed to keep a proper look-out and give warning of the approach of the car. The defenders denied fault and pleaded contributory negligence. The claim originally was for £1,000.

SMITH *v.* IMPERIAL LIGHTING CO.

IN the City of London Court on Tuesday, before Judge Lumley Smith, K.C., Mr. David Smith, trading as David Smith & Co., 3, Red Lion Court, Fleet Street, claimed £3 10s. 2d. against the Imperial Lighting Co. for electric lamps supplied.

Defendants' representative said that the lamps would only burn for a few hours, and then went out. They were put up at the Society of Motor Manufacturers' Show at Olympia. In all, 53 bad lamps were returned.

Plaintiffs said they sent 600 lamps to the defendants; they were all tested. About 32 were returned; they had burned for 200 or 300 hours. When a metal-filament lamp was touched, the filament shortened, and then double the amount of the current had to be passed through it. They might go out or blacken at once. The lamps sued for were injured after they were delivered. They were roughly used. They were 1s. 4½d. each. He did not hold himself responsible unless the lamps were returned within three days of delivery.

JUDGE LUMLEY SMITH said he remembered going to the Motor Show and seeing the lamps. Lamps could not be tested in three days, surely?

Plaintiffs said three hours was sufficient.

JUDGE LUMLEY SMITH said he knew the metal filaments were very difficult to carry.

Defendants' representative: We handle a great many.

JUDGE LUMLEY SMITH said they ought to be carried in an ambulance, because, if they were carried in a van, they got broken. He found for the plaintiffs for £3 and costs.

BUSINESS NOTES.

Royal Ediswan.—We note that the EDISON & SWAN UNITED ELECTRIC LIGHT CO., LTD., of 36, Queen Street, E.C., makers of the Royal Ediswan metal-filament and carbon-filament lamps have received the honour of appointment to Her Majesty Queen Alexandra. The firm now has an attractive poster issued by its Publicity Department displayed on the London hoardings.

Some Recent Pump and Turbine Orders.—MESSRS. BOVING & CO., LTD., report having received a considerable number of orders for Victoria turbo pumps, including the following:—The Weardale Steel, Coal and Coke Co., Ltd., one pump to deliver 450 g.p.m. against a head of 520 ft.; the South Bukeru Tin Mines, Ltd., one pump to deliver 600 g.p.m. against a head of 60 ft.; the Rhodesia Katanga Junction Railway and Minerals Co., Ltd., one pump to deliver 1,000 g.p.m. against a head of 200 ft.; the Tharsis Sulphur and Copper Co., Ltd., two units, each delivering 560 g.p.m. against a head of 322 ft. The pump for the South Bukeru Tin Mines is for hydraulic purposes.

Water turbine orders recently received include:—Two units of 1,340 B.H.P., for the Nippon Chemical Co., Japan; a unit of 265 H.P., Messrs. J. Hoyle & Sons, Lancs.; a unit of 160 H.P., F. H. Walter & Co., Rio de Janeiro; a third unit of 420 H.P., New Plymouth (N.Z.) Council.

An order has also been received from the L.C.C., for four centrifugal sewage pumps, for the Crossness station, each to deliver 22,500 g.p.m. against a head of 30 ft., and each coupled to a forced lubrication engine of 270 H.P.

Bankruptcy Proceedings.—WM. ROBERT REYNOLDS, electrical engineer, lately carrying on business at Queen Victoria Street, E.C., and elsewhere.—At a sitting of the London Bankruptcy Court held last week before Mr. Registrar Brougham, this public examination was held. The debtor returned total liabilities £1,253 (unsecured £521) and assets valued at £26. Replying to Mr. J. B. Knight, Official Receiver, the debtor stated that having for many years been in employment as an electrician, he, with a partner, started a similar business in February, 1905, at 17, Queen Victoria Street, under the style of "G. Askey & Co." Witness borrowed £50 from his father to put into the business. The partnership was dissolved in October, 1905, witness taking over all liabilities and assets,

and continuing alone under his own name. The business throughout had consisted entirely of installation work. In March, 1906, he removed to 343, High Street, East Ham, and subsequently to various other addresses in the immediate vicinity. In October, 1911, he opened another shop at 614, Romford Road, and in February, 1912, a further shop at 31, The Promenade, Palmer's Green. Owing to want of capital he was unable to keep all the shops going, and was losing money. In March, 1912, with the object of raising funds, witness sold his businesses to W. R. Reynolds, Ltd., which was formed with a nominal capital of £250. He received £1 share in the company, and the appointment of managing director at £150 per annum. The shop at 614, Romford Road, was closed in June, 1912; the company had traded at a loss, and in October last two judgment creditors levied executions at the remaining shops. Witness added that since August, 1910, he had speculated in freehold and leasehold house properties in the East Ham district. To losses on such speculations and to want of capital he attributed his present position. The examination was concluded.

Re J. W. May & Co. (Jerome Walter May, trading as), importers of lighting and other specialities, 33, Cock Lane, Snow Hill, E.C.—An application for an order of discharge was made last week at the London Bankruptcy Court by this bankrupt, who failed in October, 1911. The Official Receiver reported that the probable debts amounted to £8,725, the assets valued by the bankrupt at £1,085, had produced £547, and a dividend of 9d. in the £ had been paid to the creditors. The bankrupt came to this country from America in 1905, and for three years acted as manager for a firm dealing in lighting specialities. In May, 1908, he commenced a similar business in partnership with another person, with a capital of £300; the partner retired at the end of that year, and the bankrupt continued the business until July 15th, 1911, when he executed a deed of assignment in favour of a trustee acting on behalf of the creditors generally. The bankrupt attributed his failure to robbery by employés, heavy household expenses through the illness of his wife and family, want of capital, bad debts, and loss of trade by reason of his inability to attend properly to the business. The discharge was suspended for two years on the grounds of (1) insufficiency of assets to equal 10s. in the £ on the amount of the unsecured liabilities; and (2) imperfect books of accounts. Order entered accordingly.

W. Longdon & V. G. Cobb (Longdon & Cobb), electrical engineers, Nottingham.—Receiving order made January 15th on debtors' own petition.

R. E. Walker, electrical engineer and cycle agent, Hereford.—Supplemental dividend of 3¾d. in the £ payable February 1st at Official Receiver's office, 2, Offa Street, Hereford.

Sweden.—The output of the Allmänna Svenska Elektriska A.-B. last year showed a satisfactory increase, 8,000 electric machines having been turned out, of a total capacity of 360,000 H.P. The deliveries for the three foregoing years were:—1909, 105,000 H.P.; 1910, 230,000 H.P.; and 1911, 220,000 H.P.—*Affärsvärlden.*

Norway.—The Christiania Electrical Works have quite recently placed an order with the A/S Norwegian & Brown-Boveri for two transforming plants, each consisting of four machines of a capacity of 1,200 H.P. each. The machines are to be built at the company's works at Sköien, and are to be completed by June this year. The company has previously delivered to the municipal works three similar plants.

Book Notices.—*The Russian Year-Book, 1913.* Edited by Dr. Howard P. Kennard. London: Eyre & Spottiswoode, Ltd. 10s. 6d. net.—This, the third edition of this valuable work, is, happily, not quite so bulky as the last, as a different paper is used, but it contains quite as vast an amount of information, either written or compiled by experts on Russian affairs, or prepared by the co-operation of those in authority. The development of Russia naturally must promote great increase in engineering requirements, including, of course, electrical, and British firms who look for a larger share of business in that part of Europe and Asia will doubtless be better equipped after making a study of the material here brought together for them in convenient form. Commercial, financial, mining, agricultural, municipal and other affairs have special sections devoted to them, and "Electricity" and "Electrical Dynamos and Motors" have place in the "Trade Reports" section. Customs tariffs are fully tabulated. A calendar for 1913 indicates the dates of Russian fasts, festivals, &c.

Elementary Manual on Applied Mechanics. By Prof. A. Jamieson. London: Charles Griffin & Co. Price 3s. 6d.—The tenth edition of this popular work appears just after the lamented death of the author, whose remarkable faculty of exposition to engineering students enabled him to write a series of text-books which obtained a very wide vogue. The present work has been revised and enlarged, and the author has added recent information bearing upon examinations, together with sets of the latest examination papers of various bodies. He has also incorporated in this volume the table of engineering symbols, units and abbreviations employed in his larger text-books, as well as the symbols adopted by the International Electrotechnical Commission at Turin in 1911. One of the leading features of these books is the lavish provision of fully worked examples throughout the work, whereby any difficulty that may be experienced in following the abstract discussion of a proposition is removed by the concrete illustration thus afforded. There is also a wealth of line drawings and half-tone illustrations, constantly reminding the reader that the principles which he is studying have an immediate bearing on the practical applications of engineering to the needs of everyday life, and thus engaging and retaining his interest in a subject which, if improperly treated, can be made as dry as dust.

Text-book of Applied Mechanics. Vol. I. Price 6s.—This book, by the same author and publisher as the foregoing, is the first of the five volumes which compose the complete work, now commencing its ninth edition, and as we reviewed the seventh edition less than three years ago, we need neither notice it at length nor demonstrate its obvious popularity. Most of what we have said above regarding the elementary manual applies also to this volume, of which we can hardly speak too highly.

"Lockwood's Builder's, Architect's, Contractor's and Engineer's Price Book for 1913." Edited by F. T. W. Miller. London: Crosby Lockwood & Son. Price 4s.

"Uber die Patentsituation in der Automatischen Telephonie." By F. Aldendorff. Berlin: S. Heimann & Sohn.

"Quarterly Trade Journal of the British Chamber of Commerce of Turkey." No. 20, 1912. Constantinople: The Chamber. Price 2s. 6d.

"A Handbook of Wireless Telegraphy." By J. Erskine Murray. Fourth Edition. 1913. London: Crosby Lockwood & Son. Price 10s. 6d. net.

"The Repayment of Local and Other Loans." By Edward Hartley Turner. London: Sherratt & Hughes. Price 21s. net.

"Design and Construction of Steam Turbines." By Harold M. Martin. London: *Engineering*. Price 25s. net.

"List of Works on Aeronautics in the Science Library." "Catalogue of an Exhibition of Apparatus Illustrating the Application of Scientific Principles to Aeronautics." London: Wyman and Sons, Ltd. Price 4d. and 1d. each.

"Papers and Reports Relating to Minerals and Mining in New Zealand." 1912. Wellington, N.Z.: Government Printer.

"Specifications for and Measurement of Standard Sieves." Washington: Government Printing Office.

"Annales des Postes, Télégraphes et Téléphones." 1912. Paris: A. Dumas. Price 6 fr.

"Elektro-Ingenieur-Kalender, 1913." Berlin: Oscar Cablentz. Price M. 2.50.

"*Transactions* of the North-East Coast Institution of Engineers and Shipbuilders." Vol. XXIX, Part 3. January, 1913. Newcastle-on-Tyne: The Institution. Price 5s.

"*Boletin* de la Sociedad de Fomento Fabril." December, 1912. Santiago de Chile: The Society.

"*Bulletin* of the Association des Ingenieurs Electriciens." October, 1912. Liége: The Association. Price 5 fr.

"The A.B.C. Fiscal Handbook." 1s. net.; post free, 1s. 3d.

"Two Great Tariff Trials of 1912." By W. E. Dowding. 3d. net. London: Free Trade Union.

Messrs. Ernest Scott & Mountain's Works Purchased.—The works of Messrs. Ernest Scott & Mountain, Ltd., Gateshead, have been purchased on behalf of Messrs. C. A. Parsons & Co., of Heaton Works, Newcastle-on-Tyne, together with the more important portions of the plant and machinery and the goodwill. Owing to the large number of inquiries received by Messrs. Parsons, and to some very large contracts recently undertaken by them, the works will, in the first instance, be chiefly engaged in assisting their general manufactures, as well as continuing the business carried on by Messrs. Scott and Mountain.

River Plate.—Amongst the principal electrical goods imported during the first nine months of the year we find the following (values in dollars gold):—Accumulators, $47,370; insulators, $99,236; cables and wires, $2,231,293; telephones, $58,623; arc carbons, $109,702; dynamos and motors, $1,391,131; switches, $88,470; arc lamps, $106,960; incandescent lamps, $344,401; meters, $359,604; lampholders, $57,647; ventilators, $22,936. The total value of the electrical goods imported was $6,941,984, an increase of $2,066,601.—*Review of the River Plate.*

Catalogues and Lists. — The British Thomson-Houston Co., Ltd., Rugby.—Advance copy of a new price list describing, illustrating, and giving price and dimensional information respecting, their B.T.H. A.C. pre-payment watt-hour meter, single-phase house service type.

The British Thomson-Houston Co., Ltd., Mazda House, London, E.C.—12-page pamphlet entitled "A New Way to Sell Fittings"—building them up on the sectional system. The various parts going to make up a complete fitting are illustrated in the list. The tungstolier sectional fitting, it will be remembered, was described in these pages a short time ago. The contractor who is hampered by the cost of keeping large showroom facilities for the display of fittings can keep the separate ready-wired parts of this type of fitting ready for assembling in a few minutes, and thus needs less showroom and stock room accommodation.

Messrs. E. A. Reed & Co., Ltd., 14, Victoria Street, London, E.C.—Catalogue consisting of a number of illustrated sheets showing and briefly describing their elevators and conveyors for sacks and boxes, vertical box elevators, tray conveyors for coal and ore, gravity roller conveyors, steel buildings, roofs and chimneys.

The London Electrical Trading Co., Ltd., Palmerston House, Old Broad Street, London, E.C.—Illustrated and priced showcard of the "Pygmy" electric heater. We understand that nearly 10,000 of these heaters have been sold since they were first placed on the market last autumn. Copies of the showcard can be obtained from the firm or any of their agents.

The Dussek Bitumen Co., Canal Bank, Deptford, London, S.E.—Two pamphlets have been received; one of 12 pages gives particulars of their joint box compound (Trinidite) and tests thereon, while the other of 14 pages contains an imposing list of electric supply authorities in all parts of the kingdom who are using this compound, together with a collection of testimonials from some of

them. Copies of both lists will be sent to anybody interested in mains work.

MESSRS. DETROIT ENGINE WORKS, 94, Hatton Garden, London, E.C.—Illustrated price lists relating to the Detroit stationary oil and petrol engines.

THE HART ACCUMULATOR CO., LTD., of Marshgate Lane, Stratford, London, E., have prepared a very effective wall showcard. The pictorial part of the design embodies illustrations of typical Hart central station batteries and batteries for private installations and other purposes.

MR. A. BURROUGHS, 28, Hatton Wall, London, E.C.—Illustrated leaflets showing the firm's electric illuminated box signs for outside service, and standing signs for window and counter display.

THE BRITISH WESTINGHOUSE ELECTRIC AND MANUFACTURING CO., LTD., Trafford Park.—Small folder relating to spare parts for control gear. An illustration of a dissembled controller has a letter index to the separate parts, which can all be supplied from stock. Also a folder dealing with oil-insulated self-cooling transformers.

THE BRITISH ELECTRIC TRANSFORMER CO., LTD., 29A, Charing Cross Road, London, W.C.—Illustrated catalogue, No. 29, describing the "Tricity" non-luminous electric heater for service on board ship. Pedestal and settee types are both shown.

Private Arrangements.—R. GREGSON & CO., electrical engineers, 12, George Street, Ashton-under-Lyne, and 38, Bank Street, Rawtenstall.—The creditors interested herein were called together recently at the offices of Messrs. Hurst & Hewitt, Commercial Chambers, Corporation Street, Manchester, when a statement of affairs was presented showing liabilities of £680, all of which were due to unsecured creditors. The assets were estimated to realise £714, and a surplus was thus disclosed of £34. The assets consisted of stock-in-trade at Rawtenstall, £42; stock at Ashton-under-Lyne, £50; fixtures, fittings and utensils, £20; book debts at Rawtenstall, £210; and book debts at Ashton-under-Lyne, £392. It was reported that the business had been carried on in partnership, the partners being Richard Gregson and Wm. Gartside. They started trading about three years ago, each having a capital of about £500. Each of the debtors managed one of the businesses. It was stated that the business had been losing money, and the last balance-sheet which was prepared in March, 1912, showed a surplus of a little more than £500. In consequence of proceedings, the debtors consulted their solicitors before Christmas, when they were advised to execute a deed of assignment. Gregson did not attend at the offices to sign the deed, but he had since sent the key of the Ashton-under-Lyne premises to the trustee, together with some money. It was also reported that Gregson had gone away. The accountants subsequently made inquiries, and found that the books had not been properly written up since the date of the last audit. In the absence of Gregson, an application was made to the Registrar of the County Court for leave to register the deed in that debtor's absence. The application was refused, but the matter was taken before the Judge, and after reviewing evidence, he acceded to the application. It was, however, stated that Mr. Gartside owned a dwelling house of the value of £250, and he had deposited the deeds of that property with the trustee, and the assets would be accordingly increased. Sympathy was expressed with Mr. Gartside by the creditors, and after a short discussion it was decided that the deed of assignment already executed should be confirmed. The following are creditors:—

W. T. Henley's Telegraph Works, Ltd.	£174	Richardson & Co.	£31
Baxendale & Co.	100	Eckstein, Heap & Co.	29
Foster Engineering Co.	77	Union Electric Co.	22
Veritys, Ltd.	39	Edison & Swan Co.	16
		Siemens Bros. & Co., Ltd.	18

Dissolutions and Liquidations.—NORTH METROPOLITAN TRAMWAYS CO.—A meeting is called for February 20th at Electrical Federation Offices, London, to hear an account of the winding up from Messrs. Geo. Richardson and J. McLeod.

COWPER-COLES INVENTIONS DEVELOPMENT CO., LTD.—A meeting is called for February 25th at 1 and 2, Old Pye Street, Westminster, to hear an account of the winding up from the liquidator, Mr. W. Craddock.

MERSEY ENGINE AND PRODUCER CO., LTD.—At a meeting called for February 24th, at 3, Lord Street, Liverpool, Mr. W. E. Mounsey, the liquidator, will give an account of the winding up.

THE ELECTRICAL WIRING AND ACCESSORIES CO., Boot Buildings, Market Street, Aberdare.—Messrs. J. A. Bosher and R. S. Belsten have dissolved partnership. Mr. Belsten attends to debts, &c.

Finding Lost Pipes.—There have been several inquiries regarding the apparatus for this purpose described in our issue of December 20th, 1912. We are now able to state that the makers are Messrs. Edwin A. Mansfield & Co., 12, Beckenham Road, New Brighton, U.S.A., from whom we have received a pamphlet describing the system, and giving a long list of water and gas companies and municipalities who use it.

Annual Dinner.—The staff of the ELECTRIC CONSTRUCTION CO., LTD., held their sixth annual dinner on Friday, January 17th, at the Star and Garter Hotel, Wolverhampton. The managing director of the company (Mr. James Gray) presided over a good muster, the vice-chair being occupied by Mr. William Bulloch (a director and general manager of the company). Mr. David Willock (secretary of the company) was also present. After dinner, musical items were rendered by various members of the staff, including a "turn" by "The Shockers," a quintette of pierrots, whose performance—including several topical items written by one of the troupe—was thoroughly enjoyed. The managing director, replying to the toast of "The Company," proposed by Mr. Sam. Antwis—the oldest member of the staff present, with 30 years' service—referring to the harmonious relations existing between the directors and the staff, said, in these days of labour unrest they prided themselves on the fact that they had never had a serious dispute with their employés, and spoke very hopefully of the prospects of the company. Mr. W. Bulloch, in proposing the toast of "Our Chairman," spoke of the valuable services rendered to the company by Mr. Gray, and of the esteem and affection with which he personally regarded him. The toast of "Our Vice-Chairman" was proposed by Mr. R. Massey, and acknowledged by Mr. Bulloch. The "Dinner Committee and Artistes" was proposed by Mr. D. Willock, and responded to by Mr. W. M. Furniss.

Spain.—A foreign Consular report from Barcelona says, among other things, that without belittling the success Germany has had in Spain, it can be truly said that, if the dynamos and the larger apparatus are excepted, the goods supplied are often of very moderate quality, and would not readily be disposed of in any other European market. This is the result of the low prices at which German manufacturers are prepared to take the business solely with a view of discouraging competition by the electrical industries of other countries. It is not likely, however, that Spain will continue indefinitely to buy cheap goods which do not wear well, and, therefore, if the German plan of campaign is not altered, it is probable that her manufacturers will lose a great deal of the business that is now in their hands—at any rate as far as accessories are concerned.

Calendars.—MESSRS. W. A. WALBER & CO., 38, Victoria Street, Westminster, S.W., have issued a large wall calendar, the central feature of which is a collection of miniature half-tone illustrations of machine tools made by the firms for whom they are agents.

From the ELECTRICAL ACCESSORIES SUPPLY STORES, of 9, Queen's Terrace, Sheerness-on-Sea, we have received a neat little calendar with monthly tear-off slips.

THE BAT METER CO., LTD., 3, Eden Street, Hampstead Road, London, N.W., has likewise issued a wall calendar with monthly slips. The upper half of the sheet shows a large illustration of one of the firm's electrical meters.

MESSRS. BRECKNELL, MUNRO & ROGERS, LTD., of Thrissell Street, Bristol, have prepared a calendar with monthly slips for 1913, above which there is a print in colour of "Past and Present—H.M.S. *St. Vincent* leaving Portsmouth Harbour"—always an interesting comparison.

THE SUN ELECTRICAL CO., LTD., of Charing Cross Road, W.C., ask us to say that, in consequence of the extraordinarily large demand for the pencils prepared by them as a New Year souvenir, their stock is exhausted, and they regret inability to comply with all the requests.

Trade Announcements.—Mr. Fred. E. Trill has entered into partnership with Mr. E. A. Shaw, electrical engineer. The business will be carried on as heretofore under the style of EDWARD A. SHAW & CO., at Cape Town.

MR. R. E. CONNOLD has taken over the business formerly carried on at 6A, Parade, Canterbury, by Mr. L. A. Wells, electrical engineer and contractor.

MESSRS. J. E. ELLIOTT & CO., electrical engineers, of Broad Street, Oxford, have recently opened offices at 10, Adam Street, Adelphi, W.C.

THE SHIPLEY FAN CO. have removed to Valley Works, Shipley, owing to increased sales of fans and motors. Telephone number, "320 Shipley." Illustrated cards received show their blowing fan, exhausting fan, and Sun electric fan.

LIGHTING and POWER NOTES.

Aberdeen.—Mr. Bell, the electrical engineer to the T.C., has reported on the necessity of extending the generating plant of the Corporation at a cost of £15,510. The estimates provide for a 3,000-KW. turbo-alternator with condenser, &c. (£9,750), 1,500 KW. of converting plant (£3,600), switchgear, &c. (£750), and contingencies (£1,410). The new turbine plant will replace two existing 200-KW. engine sets which are out of date.

Arbroath.—A difference between the Town Council and the North of Scotland Entertainments, Ltd., regarding the payment of £212 for electrical equipment in connection with the reconstruction of the old Corn Exchange buildings, has been satisfactorily settled.

Argentina.—In connection with La Societa Italo-Argentina di Elettricita, the new company which has lately been formed in Buenos Ayres under Italian auspices with a capital of £440,000, to establish electricity supply undertakings in Argentina, the Pirelli Co., of Milan, Messrs. Tosi & Co., of Legnano, the well-known Italian turbine builders, and Messrs. Boveri & Co., of Baden, Switzerland, are reported to be interested in this concern.

Ayrshire.—More light is wanted at Troon, a popular watering place, and it is suggested that electricity should be introduced. It is believed that the T.C. will consider the matter.

Blackrock.—A special meeting of the Council was held on Saturday to consider what action should be taken with regard to the proposal of the Dublin Southern District Electric Supply Co. to apply to the B. of T. for a prov. order giving it liberty to supply the Blackrock district with electric current. The town clerk pointed out that the Dublin Southern Co. would supply electricity at a fraction under 5d. per unit for private purposes to the consumers in the district. The Pembroke Council would also be disposed to favourably consider the supply of electric current at the boundary of the township on terms ranging from 2½d. for 100,000 units per annum to 1½d. for a consumption exceeding 325,000 units, for a period of three years (beyond which the Council would not contract) renewable at the same terms, and it would supply at 2½d. per unit, irrespective of the quantity consumed, up to March 1st, 1914. The position, therefore, appeared to be that the Council could either decline to waive its right to the notice which should have been given by the promoters of the company in July last, with the result that Blackrock must be left out of the proposed order, or it could make an arrangement with the Pembroke Council. The Dublin Southern Co. had written stating that it was not greatly concerned whether Blackrock was included or not in the order. It was decided unanimously not to waive the Council's right to the notice which should have been delivered in July last; and further, that the district should be canvassed for consumers.

Blackburn.—The Mayor is to perform an interesting ceremony to-day at the electricity works, when he starts the new generating plant installed at a cost of £9,000. The new plant consists of two turbo alternators, two rotary converters, and the necessary switchboard, &c. These are the first turbines to be put down in Blackburn; when the first one was ordered, 12 months ago, it was got partly to enable the Corporation to start an extra-high-tension supply for cotton mills and large works. Before it was on its bed there was a demand from two mills for half of its capacity of 2,000 KW., and since then practically another 1,000 KW. has been arranged for. With the full capacity of one turbine spoken for, the Electricity Committee decided to put down another. The new plant generates three-phase alternating current at 6,600 volts, and has a speed of 3,000 R.P.M. The two rotary converters are already in position; each has a capacity of 1,000 H.P. and a speed of 600 R.P.M. The two cotton weaving mills to be run by the first turbine are the one at Skew Bridge, which has 1,040 looms, and Cicely Bridge extension, 370 looms; each loom has its own motor. The new plant has been installed by the British Westinghouse Co. A cooling tower, 106 ft. high, is shortly to be erected. The tower foundations and auxiliaries will cost approximately £2,600, and it will be capable of dealing with 200,000 gallons per hour. The order has been placed with the Davenport Engineering Co. The whole of the work has been done to specifications by Mr. Wheelwright, the borough electrical engineer.

Bolton.—The Electricity Committee has referred to the chairman and vice-chairman, applications from the following mills and works for current for motive power:—Messrs. Slater & Co., Ltd., Bolton Bleachworks; Messrs. R. Entwistle & Co., Lincoln Mill; Messrs. J. Marsden & Co., Britannia Works; Messrs. Winder and McKean, Bradford Mills, and the Victoria Mill.

Brighton.—The T.C. has decided to install an electric cooking outfit, at a cost of £55, on the Crown Street premises of Messrs. Stafford, who are constructing a new staff kitchen. The firm have promised to use electricity if the Council puts in the apparatus.

Church (near Oswaldtwistle).—The U.D.C. has decided that Blackburn Road and Market Street be lighted by electricity, and a sub-Committee has been appointed to make arrangements and report.

Continental Notes.—FINLAND.—It is announced from Helsingfors that the Finnish Senate has discussed the question of the utilisation of the falls on the River Vouoksia, and that an inter-Departmental Committee has been appointed to draw up the conditions for the immediate utilisation of the Grande Imatra Falls. The electrical energy generated will be utilised for traction purposes on the Saimenski Canal, for the electrification of the St. Petersburg-Viborg railway, for lighting and power purposes in the town and district of Viborg, while part will be transmitted to St. Petersburg for a similar purpose. It is estimated that the portion of the falls to be utilised will yield an electrical output of 450 million KW.-hours per year. The necessary plant will be installed on Government account, the Finnish Senate having decided not to hand it over to private concessionaires.

NORWAY.—The Municipality of Tromsö has recently contracted for a new electricity works, with equipment by the Elektrisk Bureau of Christiania. Two generators of 600 H.P. each, with the necessary transformers and switches, will be installed. The electric power will be derived from a waterfall situated at some distance from the town, and will be transmitted at 12,000 volts. This undertaking is not a very big one, but it has some very interesting features in regard to the question of transmission. Tromsö is situated on an island, while the waterfall, from which the energy is to be obtained, is situated on the mainland. This necessitates the transmission of power by submarine cables across two sounds, one of which is 850 m. wide, and the other 625 m. The works are to be completed by August next.

The Elektrisk Bureau has also obtained an order from the Sulitelma Copper Mines for the delivery of two generators, to be installed at the Fineide power station, which will be extended.

The municipal authorities of Christiania are reported to be considering a scheme to establish a plant, 25 miles from the city, to utilise the water power of the Halfred and Solberfos Falls on the River Glommen, in the generation of electrical energy. It is stated that about 27,000 H.P. will be available.

GERMANY.—The recently-formed Thuringer Electricitäts Lieferungs Gesellschaft has placed a contract with the A.E.G. for the construction of an overland transmission station for the Duchies of Gotha and Meiningen, and the districts of Schmalkalden and Schleusingen. The power station, which will have a temporary capacity of 14,000 H.P., will be located near Altenbreitungen a.d. Werra.

The municipal authorities of Hagen, Westphalia, are reported to have placed an order with Messrs. Brown, Boveri & Co., of Mannheim, for what it is claimed will be the largest steam turbine and dynamo so far built. It will be of 35,000 H.P., and is to be added to the plant at the municipal central station at Hagen.

Cromer.—At a meeting of the U.D.C. on January 13th it was decided that the proposed transfer of the electric lighting undertaking to Messrs. Edmundsons should remain in abeyance with a view to a referendum of all the ratepayers being taken at once on the question.

Croydon.—The B.C. has sanctioned the sinking of a well at the electricity works at a cost of £1,200. Owing to the proximity of the River Wandle, the amount of water to be extracted must not exceed an average of 4,000 gallons per hour in any period of 30 days.

Dawlish.—The U.D.C. has decided to increase the number of street electric lamps by 30.

Ealing.—The chairman and borough electrical engineer have been instructed by the B.C. to make inquiries and report upon a letter received from Messrs. Handcock & Dykes, on behalf of the Fixed Price Lighting Co., for putting its scheme into operation in this district.

The B.C. has decided that in future the charge for electric current supplied for outside illuminated signs and for outside incandescent shop lighting shall be 4d. per unit.

Edinburgh.—In spite of protests from the electrical trade of the city, the Corporation has decided to retain in its prov. order the clause which gives it power to sell and hire electrical apparatus. In one respect, however, the recent deputation from the traders heard by the Council has prevailed, for the Corporation will not carry out any wiring. Mr. Walter Finlay, who speaks on behalf of the traders, says what they desire is freedom from rate-aided competition, which is the most serious menace that can be met with so far as they are concerned. They contend that in Edinburgh there are ample showrooms for the consumers to see the most recent electrical appliances.

Epsom.—A town's meeting was held on the 15th inst. to consider the Bill which the U.D.C. proposed to promote in Parliament in order to provide further powers in connection with the municipal electricity and water undertakings and other matters. On behalf of the Council, it was stated that the electricity undertaking was costing the town £1,120 less than in 1908, and that a proposal was to be immediately considered to reduce the price of current for power purposes from 2¾d. to 1½d. per unit. A vote was taken which showed a majority of about 2 to 1 against the Bill.

The R.D.C., on January 15th, approved of plans for the extension of the mains of the Leatherhead and District Electricity Co. from Fetcham to the Effingham district. The company has also submitted a draft prov. order for electric light in the parishes of Cobham, Stoke D'Abernon, Great Bookham, and Little Bookham, and this was referred to a Committee.

Glasgow.—A special Sub-Committee of the Electricity Committee has been appointed to consider and report on a letter submitted on behalf of a number of electrical firms in Glasgow, for the organisation, under the auspices of the T.C., of an Electrical Manufacturers' Exhibition in the city.

Guildford.—An application has been made by the Electricity Supply Co., to the B. of T. for consent to construct a generating station on land adjoining the existing works of the company.

Helsby.—The P.C. is considering the advisability of utilising electricity at the sewerage works, and an estimate of the cost, as compared with gas, is being prepared.

Hendon.—The Colne Valley Electricity Supply Co. has agreed to the R.D.C.'s suggestions that the price of current should be fixed at 6d. per unit for lighting and 3d. for power, and that a clause should be included in the proposed prov. order giving the Council the option of purchasing the undertaking on the expiration of 21 years. Under these circumstances the Council's opposition to the scheme is to be withdrawn.

Hoddesdon.—The B. of T. has revoked the 1901 E.L. Order.

Hove.—A statutory town's meeting was held on January 17th to decided whether the Corporation shall promote a Bill in Parliament for the purchase of the Hove E.L. Co.'s undertaking. The Mayor pointed out that the purchase had been decided on, and it was now desired to obtain Parliamentary powers, as it was hoped that the repayment would then be extended over 40 years, while the alternative of L.G.B.'s sanctions would probably mean repayment in 15 to 20 years. The loan repayment for 40 years would only amount to £9,500 per annum, and would be about £14,000 for 20 years. The resolution was lost on a vote, and a poll of the ratepayers has been demanded.

Knighton (Radnorshire).—A largely-attended meeting of ratepayers has by an almost unanimous vote resolved that the private company which had applied for permission should undertake the electric lighting scheme, subject to its being acquired by the Council at a future date.

Liverpool.—Further extensions are proposed at the Lister-Drive power station, where additions were made in the early part of last year by the installation of two 2,000-KW. D.C. turbo-generators, and two 3,500-KW. turbo-alternators. At the meeting of the Electrical Sub-Committee on January 17th, a report was received from Mr. H. Dickinson, chief electrical engineer, on the proposed further extension of the works. Owing to the laying of additional tramways, and the increase in the number of cars running besides the considerably increased demand for current, the generating plant at Lister-Drive has required to be not only modernised, but considerably increased in capacity. The report recommends an increase capable of meeting present and future needs for many years to come. As the details were considerable, the Committee decided to take time for each member to study the scheme for himself, and it was agreed to deal with it at a subsequent meeting.

Long Eaton.—The U.D.C. on Monday gave instructions for plans, specifications and estimates to be prepared for extensions at the electricity works, with a view to a loan of £8,000 being applied for. The proposals are to install a 500-KW. steam dynamo and accessories, a Babcock & Wilcox water-tube boiler, and erect an engine room, boiler room and office extensions.

London.—BERMONDSEY.—An addition has been made to the assessment of the undertaking of £1,195 gross, and £530 rateable, in respect of the recent additions to the generating station.

HACKNEY.—The Electricity Committee reports having had under consideration the necessity of proceeding with the first part of the system of ring mains, sub-stations and sub-feeders in connection with the scheme adopted in March last for the extension of the undertaking. The maximum demands this year have already exceeded what was anticipated for next January, viz., 4,150 KW., and the strain of the heavy load was being acutely felt upon the mains and plant. A site for the northern sub-station, the Committee states, has been obtained, and immediate steps should be taken to secure sites for the south-eastern and south-western sub-stations. The immediate load that will be dealt with by these sub-stations will be approximately 1,700 KW., and to meet this load plant should be provided having a total capacity of 3,000 KW. With regard to the system of ring mains the Committee proposes to lay fibre ducts which will accommodate cables for 12,000 KW., with telephone cable and pilot wires. At present provision was being made for drawing in one cable only to deal with a load of 3,000 KW. when fed from both ends, or 1,500 KW. in the event of a fault occurring in the worst possible position. For the transmission of the low-tension current from the generating and sub-stations, it is proposed to use the existing feeder cables and to run out several new cables from the sub-stations. The general principle of the proposed arrangements is to increase the capacity of the feeders to existing feeding centres by joining existing cables in parallel, so that these centres may still be supplied from the generating works, at low pressure and without excessive loss, while the ends of the longer feeders will be cut off and connected to the sub-stations. The Committee recommends (1) that the proposed scheme of extensions be approved; (2) that tenders be invited for the erection of the three sub-station buildings and the sub-station plant; (3) that the necessary cables and boxes be purchased under the current contracts for these materials, and that tenders be invited for supplying and laying the conduits, &c.; (4) that application be made to the L.C.C. for loans aggregating £53,550.

POPLAR.—As loans of £2,885 for buildings, £1,000 for mains, and £2,115 for machinery are required in respect of extensions to the electricity undertaking, and as no better terms than 4 per cent. can be obtained, it has been decided to borrow the machinery amount from the Council's superannuation and pension fund at 4 per cent. interest, and the two remaining items from the L.C.C.

SHOREDITCH.—The Lighting Committee reports having carried out experiments over a long period with a new type of flame lamp for the purpose of improving street lighting. The electrical engineer reports that if magazine type flame arc lamps are adopted, not only will a great saving be effected after the new lamps are paid for, but an increase of nearly 100 per cent. will be gained in illuminating power. It is estimated that the saving per annum on a circuit of 24 lamps, including current and attendance, after allowing for the slightly increased cost of carbons, will be about £124. After fully considering the matter and in view of the great increase of vehicular traffic, also in the speed of all kinds of motor traffic, the Committee expresses the opinion that the improved lighting of the streets, especially main thoroughfares, is of urgent importance, and it has decided to purchase 96 lamps as follows:—48 "Metroflam" arc lamps, burning 70-80 hours, from Johnson & Phillips, at £9 10s. each, and 48 "Angold" arc lamps, burning 90 hours, from the General Electric Co., at £10 each. An expenditure of £300 has been approved for the supply of new meters.

Lowestoft.—The electrical engineer reports that the total receipts of the undertaking amounted last year to £15,992, which shows an increase of £163 on the year's work, and which, after paying all working expenses and small extensions, left a gross profit of £7,489, which is equal to 7½ per cent. on the outlay. From this amount must be deducted payments made out of appropriation account for some work which it has been found necessary to carry out. The interest and sinking fund charges have increased from £6,767 to £7,283. This large increase is entirely due to the short loans which the L.G.B. is now only allowing. The total number of units generated amounts to 1,507,990, showing an increase of 99,753.

Mansfield Woodhouse.—The U.D.C. has decided to have certain thoroughfares lighted by electricity. Double 100-C.P. lamps will be charged £10 each per annum, and double 50-C.P. lamps £5 10s. per annum. Under agreement with the Mansfield T.C., current will be supplied under the maximum demand system at 7d. and 2d., and on the flat-rate at 4½d. per unit for lighting; and for power at 4d. and 1d.

Margate.—The T.C. proposes to install three lifts in the town, one from the Fort Promenade to the Lower Promenade; another at Newgate Gapway; and a third from the Cliffs to the Lower Promenade at Palm Bay. The Works Committee is to prepare a report as to the cost, &c.

Middleton.—The application of the T.C. for sanction to borrow £7,200 for the purposes of the electricity undertaking was inquired into by Mr. T. C. Ekin, of the L.G.B., on January 17th. Mr. S. Pauls, borough electrical engineer, gave particulars of the requirements, which showed that out of the £7,200, it was intended to expend £5,200 on cables, and the remainder on a steam dynamo, and accessories. The Committee had been spending some £900 a year on mains, and he estimated that to meet the great demand for current it would have to spend £1,000 in the future. The Garden City accounted for a large increase, as well as the improvements in lighting. He was quite satisfied that they would be able to spend the money within the next three years. There was no opposition. In connection with this scheme, the Council has placed a contract with the Lancashire Dynamo and Motor Co. for a 300-400-KW. dynamo, and with Messrs. Belliss for an engine.

Orsett.—The R.D.C. has consented to the application of the County of London Electric Supply Co., Ltd., for a prov. order for electric light in the rural area.

Portslade.—The U.D.C. has resolved not to approve of the Bill of the Hove T.C. to purchase the undertaking of the Hove Electric Light Co., owing to Portslade being included in the area of supply, and to request the Hove Corporation to strike out everything contained in the Bill affecting the urban district.

Queensferry (Ches.).—The lighting of the district has been under consideration for some time, both by the P.C. and the West Saltney R.D.C., and the latter authority at its last meeting approved a resolution, passed by a ratepayers' meeting, that steps be taken to have Queensferry lighted by electricity. Mr. T. M. Dutton, who was present at the meeting of Queensferry ratepayers, considered that a suitable plant could be put down for about £1,500, and he suggested that a deputation should view the scheme in operation in Caergwrle. The estimate referred to had, he said, been sent in by Sandycrofts, Ltd., but he was simply there to explain the scheme as an interested ratepayer, having severed his connection with that company. An amendment, suggesting that the Connahs Quay Gas Co. be again approached before anything definite was done, was rejected by a large majority.

Rawtenstall.—A new engine room has been added to the electrical generating station, with a 1,000-H.P. Belliss engine and three-phase alternator. The alternator has been made by the General Electric Co., and supplies current at a pressure of 3,000 volts. A second set which is being placed in the power house is an exact replica of the one above-mentioned. Three condensers of the ejector type have been installed, and a fourth is being added. A new intake, with screening apparatus, has also been installed, and a new boiler by Messrs. Yates & Thom. The demand for current is increasing so fast in both Bacup and Rawtenstall, that there is practically a full load waiting for th extended plant.

Rochdale.—At a meeting of the Corporation Gas and Electricity Committee last week, a letter was read from the Salford Corporation thanking the Committee for the help rendered at the time of the disastrous fire at Salford. One of the members of the Committee asked the electrical engineer if the Rochdale works were reasonably safe against such a calamitous outbreak, and Mr. Atchison replied that it was practically impossible for the Rochdale works, constructed as they are, to be burnt out, and as far as human foresight could do it, they were safeguarded against serious results from fire.

Romford.—After discussing the matter *in camera*, the Finance and Parliamentary Committee of the U.D.C. has further deferred action with regard to the applications for prov. orders for electric supply by the London Electric Supply Co. and Mr. W. T. Pressland. Further information is to be obtained.

Sanderstead.—At the last meeting of the Parochial Committee, it was stated that the County of London Co. had written to the Coulsdon and Beddington Councils, offering to light the streets under their jurisdiction at a moderate rate now that the company was bringing its own H.T. supply from Wandsworth. The Committee decided to write to the company, asking its charges and what roads would be included.

Scarborough.—The Corporation has appointed a special committee to consider and report upon the question of the exercise of its right of purchase of the local electric lighting undertaking.

South Africa.—The Paarl Cape Province ratepayers have sanctioned the raising of a loan of £35,000 to be expended on an electric light installation. The scheme proposes to use water as the prime motive power, and this is to be obtained from the Nantes and Bethal streams and stored in a reservoir on the mountain. The reservoir will have a storage capacity of 121,000,000 gallons. The engineer for the scheme is Mr. Thomas Stewart, M.I.C.E., of Cape Town. The dam is estimated to cost £22,000, plant and power station £5,100, and 12 miles of street lights and mains for private consumers £7,365.

Southampton.—The Corporation electricity department has just issued a well-printed booklet on "Heating by Electricity." A view on the cover shows the exterior of the up-to-date showrooms at Above Bar, and the contents deal concisely with the various phases of electrical heating, which, as our readers are aware, has been energetically introduced by the local electricity department with very successful results. Included in the booklet is a list of a dozen local contractors.

Surbiton.—At the last meeting of the District Council, the report of Mr. J. F. C. Snell on the electricity undertaking for the six months ended September 30th, 1912, was considered. During the half-year 114,848 units were sold at an average price of 4·8d. per unit, as against 98,493 units at 4·9d. in the previous year, or an increase of 16,353 units, equivalent to 16·6 per cent., which he considered most satisfactory.

Swansea.—The electrical engineer has been instructed to prepare the necessary specifications, &c., for installing electric light at the new training college, and tenders are to be invited for carrying out the work.

Swinton.—An arrangement has been made between the District Council and the Lancashire Electric Power Co. whereby it will soon be possible for the Broad Oak Park area at Swinton to have a supply of electricity for lighting purposes. Subject to the sanction of the L.G.B., it has been arranged that the company shall deliver electricity at high pressure at the Council's boundary at Sindsley, and the Council will erect a transformer and lay supply cables through the park. The clerk has been instructed to make application for the necessary powers and for a loan of £600, and it is expected that the work will be proceeded with as soon as sanction is obtained.

Uruguay.—According to the *Review of the River Plate*, the Government has issued specifications for the erection of electric light works in various cities and towns. The 16 installations are divided into five groups; group "A" comprises La Paz and Las Piedras, which will receive their current from the Monte Video station. Group "B" comprises Guadalupe, Pando and Santa Rosa, which will each have their own station. Group "C" comprises San Eugenio and San Fructuoso, each with its own station, and Maldonado, San Carlos and Punta del Este, which would be served from a station at Maldonado. Group "D" comprises Dolores, Nueva Palmira and Rosario, each with their own station. Group "E" comprises Batlle y Ordonez, Sarandi del Yi and Treinta y Tres, each with their own station.

Venezuela.—In our note of last week, for the Harbour of "Caracas" read "Curaçao."

Wallasey.—It is anticipated that at the next meeting of the Council the chairman of the Electricity Committee will bring forward a scheme for extending the electricity undertaking at a cost estimated at £65,000. For some considerable time past the demand for current for power purposes has exceeded the supply, in addition to which an application was recently received from a local business concern for an annual supply of 3,000,000 units. The responsible committee in the past has, however, failed to keep abreast with the times, the consequence being that the existing plant at the electricity station in Seaview Road, Liscard, is quite inadequate for present-day requirements. The new Committee proposes to remedy this and to embark upon a policy of a decidedly progressive character. The proposal is to erect, at an estimated expenditure of £60,000-£65,000, a new power station in the Poulton area, whence it is anticipated there will be a goodly number of consumers from the many industrial undertakings situated in the neighbourhood. In addition to this, power could be provided for working the tramway service at a cheaper rate than at the present time. It is thought an adequate extension and development of the electricity undertaking will have an important bearing upon the prosperity of the town.

Watford.—A provisional order is to be promoted next autumn for giving a supply to Bushey.

Whitstable.—At a meeting of the U.D.C., on January 14th, Messrs. G. Stainton, Campbell and Norman attended respecting the proposed electric lighting scheme. The Council was asked to grant permission for Mr. Campbell, on behalf of a company, to install an electric light system in the town by means of overhead wires, to utilise electricity for public lighting and sewerage pumping, and to undertake not to oppose the application for a prov. order. Mr. Stainton said the company would supply 50 or 60-c.p. lamps at £3 5s. per annum, against £3 10s. at present paid for gas lamps. The Council will consider the matter at a special meeting.

TRAMWAY and RAILWAY NOTES.

Blackpool.—The Tramways and Electricity Committee has decided that application be made to the B. of T. for sanction to borrow £10,000 for the following extensions of the Corporation's tramway undertaking:—Extension of Marton tram depôt; extension of workshop accommodation, Blundell Street depôt; extension of storage accommodation, Blundell Street depôt; six new open-type tramcars and electrical equipment therefor, and cables, sundries and accessories.

Bournemouth.—The long-debated question of Sunday running of the cars has at last been decided by a poll of the ratepayers, when 4,716 voted for and 4,268 against the proposal, showing a majority in favour of 448. A similar poll in 1906 resulted in a majority of 903 against Sunday running.

Continental Notes.—AUSTRIA.—The construction of an electric tramway between the towns of Parbuditz and Sezemitz, Bohemia, has been decided upon.

FRANCE.—A company styled the Chemins-de-fer Electriques de la Champagne has been constituted for the building and working of a network of local railways in the Départements de l'Aube et de l'Yonne. The gauge of the railways is 1 metre, and the extent of the system 194 km. Single-phase current is to be used, and the company will draw a portion of its supply from the Société Lyonnaise des Eaux et de l'Eclairage. A concession for 50 years has been secured.—*La Lumière Electrique.*

Croydon.—The Tramways Committee of the B.C. reported on Monday that it had considered a proposal from the L.C.C. for the running of through cars between London and Croydon. Having regard to the capital expenditure, estimated at about £60,000, which would be involved in adapting the Croydon system to suit the L.C.C. cars, the Committee recommended that the proposal be not entertained at the present time. The Committee also had under consideration reports by the town clerk and other officials regarding the powers of the Council in the matter of compulsory purchase of the portion of the South Metropolitan Electric Tramways within the borough. Having regard to the whole of the circumstances, the Committee recommended that those powers should not be exercised "at the present period." The routes affected are between the West Croydon terminus and the borough boundary (close to Mitcham Common), and from Church Street to the borough boundary in Stafford Road, Wallington (on the Sutton line). These recommendations were adopted. There was a long discussion over the Whitehorse Road route, which has been run at a loss since November, 1906, except for a period when it was closed. The manager (Mr. T. B. Goodyer) submitted an analysis of receipts, expenses, &c., for December 21st and January 3rd, representing losses of £963 and £1,573 respectively annually.

Dundee.—The Corporation Tramway Committee has delayed for three months consideration of the proposal to extend the railless traction system from Clepington Road to Lochee. Mr P. Fisher, the manager, estimates the cost of equipping the proposed route at £1,000. Two additional cars would be required at £700 each, bringing the estimated total capital expenditure to £2,400. Mr. Fisher says the system has worked smoothly, and is as reliable as an ordinary tramway service. The earnings on certain days, reaching as high as 25·3d. per mile run, proved that with this system heavy traffic could be successfully dealt with. In this quiet winter time, from 2,000 to 3,000 persons were using the cars every week. The service proposed, he states, would be of considerable public benefit, and undoubtedly a traffic would be developed which in time would be a paying one.

Glasgow.—The T.C.'s Sub-Committee on Extensions is to consider the advisability, in the event of the route being extended from Baillieston to Coatbridge, of a further extension to Airdrie, as well as an extension from the present line at Clydebank to Duntocher and Hardgate.

Holywell.—The U.D.C. has decided to take up £3,000 worth of shares in the Mid-Flintshire Light Railway, subject to approval at a ratepayers' meeting. The R.D.C. has also decided to take shares to the value of £7,000, subject to the approval of the L.G.B.

Irlam.—The T.C. has been considering the question of installing a railless trolley system, or running motor-'buses, but the matter is not going to be proceeded with at present. The clerk informed the Council last week that a private Act of Parliament, costing anything from £200 to £1,000, would be necessary, and also that the proprietor of the present horse 'bus system declared that the passenger traffic did not pay. In view of those facts, the suggested conference with local employers on the matter was not considered necessary.

Leith.—The Tramways Committee of the T.C. has asked the Management Sub-Committee to report upon the proposal to form an extension of the tramways from Seafield terminus to King's Road, Portobello.

London.—ISLINGTON.—A petition is to be lodged against the L.C.C. (Tramways, Trolley Vehicles and Improvements) Bill, for the protection of the Council's interests. The Committee in charge of the matter states that, as regards the proposal to work trolley vehicles, such powers, if obtained, will create a precedent which may render valueless the power of veto conferred upon Metropolitan Borough Councils by Sec. 23 of the L.C.C. (Electrical Power) Act

1900, which prohibits the placing of wires in any street for an overhead system of traction unless the Council of the Borough in which such street is situate has consented thereto. It is doubtful whether the Council has a *locus standi* to oppose the present Bill when in Committee of the House of Commons as regards this point, but it may become necessary at a subsequent stage for the Council to take action for the protection of its interests.

Liverpool.—The Tramways and Electricity Committee on January 17th considered the estimates for 1913, and found itself in a position to allocate £97,000 to the relief of the rates, a sum equal to a rate of 6½d. in the £. The profit has accrued, as to £67,000 on the tramways undertaking, and as to £30,000 on electric power and lighting. This is compared with £38,000 and £25,000 respectively in 1911.

Matlock.—A special meeting of the D.C. is to be held to consider what steps should be taken with regard to the working of the cable tramways.

Oldham.—It is stated that the Tramways Committee will probably place the order for two motor-'buses shortly.

Sheffield.—The City Council has adopted the proposal of the Tramways and Electric Light Joint Committee for connecting the power stations, so that the supply from both may be available for the tramways.

Southport.—Mr. Mallins, of the Liverpool Tramways, recently made several recommendations to the Tramways Committee in regard to the reorganisation of the tramway service, and the Sub-Committee on the tramways recommended the abolition of all contracts and preferential fares, except current contracts and statutory charges to the working classes. At the T.C. meeting last week an amendment for the continuance of the contract tickets was defeated by 27 votes to 21. The T.C. decided to purchase two omnibuses at £900 each.

Whitby.—The U.D.C. has decided to acquire land for a cliff tramway and lift from the beach.

TELEGRAPH and TELEPHONE NOTES.

The Atlantic Cable Combine.—An article in the *Postal Telegraph*, of New York, suggests that it is only a question of time before the U.S. Government will break up the combination which the Western Union Telegraph Co. has made in the trans-Atlantic cable business, by leasing the cables of the Anglo-American and the Direct United States Cable Companies, on the ground that it constitutes a flagrant violation of the Anti-Trust Act of 1890. In that event the British shareholders would have to resume possession of their cables and work them without an agreement with the Western Union.

France.—A large wireless station is shortly to be constructud on the Bay of Bourgneuf, on the west coast of France, at a spot two miles inland.

Imperial Wireless System.—The Select Committee on the Marconi agreement resumed its sittings on Monday, when a letter from the Marconi Co. to the Postmaster-General was read. The letter, which was a very long one, stated that when the tender of March 7th was submitted, the company supposed that the agreement would be drawn up and ratified within a few weeks, and accordingly retained in England a large staff of engineers in readiness to commence the work. Instead, however, of ratifying the agreement in July, Parliament appointed a Select Committee which had sat for over three months, but had not yet taken evidence on long-distance wireless telegraphy from those best qualified to give it, while erroneous statements had been published which were very detrimental to the company. The latter regretted that the proposed Technical Committee was not appointed three months ago; the staff of engineers had been kept idle for many months, at great cost to the company, and the cost of materials had risen substantially since the contract was entered into. Mr. Godfrey Isaacs, who signed the letter, submitted that it was inequitable that his company should remain bound whilst investigations never contemplated were continued over an indefinite period, and stated that in order to maintain the company's position here and abroad their engineers must be released, and Mr. Marconi and he must be freed to attend to other important work. He therefore requested the Government to agree to the company's treating the contract as no longer binding upon either party. When the investigations were completed his company would be prepared to devote their whole energy, experience and staff to the construction of the Imperial stations on such terms as might be then agreed, if the Government should so desire.

In the meantime Mr. Marconi and the company's engineers awaited the opportunity of appearing before the proposed Technical Committee. Mr. Marconi, who became a party to the agreement at the express wish of the Department, endorsed this letter so far as it concerned him personally.

The examination of Sir G. C. Marks, M.P., was then resumed. He said that he would recommend the Committee to proceed on entirely new lines, asking the company for a price for the installation independent of royalties, the sum to include the right to use their patents. What the Government had already done on their ships they could do on land; consulting engineers could be asked to prepare specifications and carry out the work. If Clause 3 had remained in the agreement, the whole value of the Marconi patents would have been destroyed during the existence of the contract, by the operation of Clause 38 of the Patents Act. The witness agreed to prepare a memorandum of the modifications that he would propose in the contract.

Mr. Viggo Gandil was recalled, and repeated his statement that Mr. Farnall, of the Post Office, had definitely offered on behalf of the Postmaster-General to purchase the whole of the Poulsen patent rights. Mr. Farnall was also recalled, and said that he did not make any offer to buy. He was instructed by the Postmaster-General to find out whether the Poulsen people were prepared to sell their patents. He admitted that his previous answer did imply that there was an offer to buy. The Postmaster-General was afraid the Marconi Co. would buy up the Poulsen patents.

On Wednesday the examination of Mr. Farnall was continued and concluded, and Mr. W. R. Lawson, a financial expert, gave evidence

Norway.—The Cabinet has decided to recommend the Storthing to approve the Marconi wireless contract arranged on behalf of the State by M. Heftye, Director of Telegraphs.

The Recent Storms.—Some idea of the results of the recent snowstorms may be gathered from the facts that approximately 1,600 miles of telegraph and telephone wires were down in the north-east of England, and that for some days Newcastle-on-Tyne was practically isolated, except for its limited means of communication by underground wires.

Scottish Telegraphs.—A deputation recently waited on the Postmaster-General, with a view to inducing him to extend the underground cable to Dundee and Aberdeen, but Mr. Samuel stated that the revenue was only £16,000 a year, whereas the cost of the cable would be £130,000. Questioned in the House of Commons on Monday, Mr. Samuel admitted that the revenue should have been stated as £30,000, but even that would not justify so heavy an expenditure.

Wireless Telegraphy.—A contract has been placed by the Great Western Railway Co. for the erection of a wireless station close to Fishguard Harbour, to communicate with the company's cross-Channel steamers.

CONTRACTS OPEN and CLOSED.

OPEN

Aberdeen.—February 10th. One 3,000-KW. turbo-alternator, with surface condenser and air pump, for the Corporation. See "Official Notices" to-day.

Atherton.—January 29th. One E.H.T. switchboard and one H.T. switchboard for the U.D.C. See "Official Notices" December 27th.

Australia.—VICTORIA.—February 21st. Four 1,500-KW. rotary converters, for the Melbourne City Council. See "Official Notices" December 6th.

WESTERN AUSTRALIA.—February 19th. Armoured telegraph cable, for the P.M.G.'s department. See "Official Notices" January 10th.

February 27th.—Buildings and boiler house equipment, turbo-alternators and rotary converters, for a Government power station at Perth. See "Official Notices" to-day.

SYDNEY.—March 17th. Motors for the City Corporation.

Belgium.—LIERRE.—February 28th. Tenders are invited for a concession to install and work an electric lighting service. Particulars, Hôtel de Ville, Lierre.

BRUSSELS.—January 29th. Tenders are required for the supply of cable and accessories for the Administration of the Telegraphs. Cahier des charges spécial No. 3,624. Tenders to the Administration des Télégraphes, Salle de la Madeleine, Brussels.

Birkenhead.—February 11th. Continuous-current electricity meters and house service fuse boxes, for the Corporation. See "Official Notices" to-day.

Birmingham.—January 27th. Stores for a year for the Corporation Tramways. Mr. A. Baker, manager.

Bolton.—February 13th. Turbo-alternators with condensing plant, water-tube boilers, economisers, switchgear and steam feed pumps, for the Corporation. See "Official Notices" to-day.

Bridlington.—February 8th. One 600-KW. turbo-generator, with switchboard and pipework extensions, for the Corporation. See "Official Notices" to-day.

Canada.—February 13th. Machines, motors, cranes, &c., for Transcona Railway shops. Specifications and forms of tender from Mr. W. J. Press, engineer, Ottawa.

February 10th.—One 1,500-KW. steam turbine and generator, for the City of Moose Jaw, Sask. See "Official Notices" January 10th.

Cheltenham.—January 30th. Electric light fittings for a year, for the T.C. Mr. J. S. Pickering, borough engineer, Municipal Offices.

China.—January 30th. High and low-tension underground cable, for the Shanghai Municipal Council. See "Official Notices" January 17th.

February 6th.—Six 625-K.V.A. three-phase oil-cooled transformers, for the Shanghai Municipal Council. See "Official Notices" to-day.

Clacton-on-Sea.—January 29th. One 250-KW. Diesel oil engine, generator, switchboard, &c., for the U.D.C. See "Official Notices" January 10th.

Colchester.—February 10th. Duplicate motor-driven air-compressor plant, with pipework, cables, switchgear, &c., for the Committee of Visitors, Essex and Colchester Asylums. See "Official Notices" to-day.

Constantine.—January 1st, 1914. The contract with the local gas company expiring in 1920, the Mayor is prepared to receive offers from individuals or companies prepared to provide a public and private lighting service either by gas or electricity, together or separately, in separate tenders or jointly. The concession will be for a term of years, and tenderers must offer advantages in the shape of a share in the profits, or free public lighting, and a graduated scale of prices for private consumers. Particulars at the Mairie.

Costa Rica.—As only one tender (from a French firm) was submitted for the 50-year electric tramway concession, the date for receipt of offers has been extended to January 31st. Further particulars appear in the last issue of the *Board of Trade Journal*.

Dublin.—February 13th. Water-tube boilers, economisers, pumps, conveying plant, pipework, &c., also boiler seatings and flue work, for the Corporation Electricity Supply Committee. See "Official Notices" to-day.

Edinburgh.—The Corporation invites tenders for the providing and fixing in position at the Usher Hall, Edinburgh, of a complete vacuum cleaning installation, the plant to include a stationary motor-driven rotary suction pump. Mr. A. Newington, Corporation electrical engineer.

Egypt.—March 31st. Section des Municipalités invites tenders for electric light installation at Damietta. Section I: Generating plant and tools and machines for repair shop. Section II: Distributing system, *i.e.*, transformers, H.T. cables, and L.T. aerial lines. Sir A. L. Webb, Queen Anne's Chambers, Broadway, S.W., and Mons. le Directeur de la Section des Municipalités et Commissiones Locales, Ministère de l'Interieur, Cairo.—*Board of Trade Journal*.

Epsom.—The Water Co. are advertising for tenders for the installation of an electrical pumping plant at their works. Estimated cost, £465.

Fleetwood.—February 4th. One 500-KW. mixed-pressure turbine and continuous-current dynamo, with condensing plant, and one water-tube boiler, superheater and brickwork, for the U.D.C. See "Official Notices" to-day.

France.—PERONNE.—February 15th. Tenders are requested for the construction of a reservoir and the supply and erection of motors and pumps. Lot 4, motors and pumps 15,500 fr.; guarantee, 450 fr. Particulars, M. Lagrange, Ingénieur des Ponts et Chaussées, Péronne.

Germany.—CHARLOTTENBURG.—The T.C. will shortly be placing orders for a 6,000-KW. turbo-dynamo and necessary boiler plant for the municipal station. Particulars of the Magistrat, Charlottenburg.

Glasgow.—The Committee on Tramways, Works and Stores, has decided that in future each car shall carry a lifting jack, and the general manager, Mr. Dalrymple, has been instructed to get orders for the necessary number, over 800.

200 electric hand lamps for members of the police force. Mr. W. W. Lackie, chief electrical engineer, Waterloo Street.

Grimsby.—February 11th. One 1,000-KW. mixed-pressure turbine and continuous-current dynamo, with condensing plant, for the Corporation. See "Official Notices" to-day.

Hoylake and West Kirby.—January 31st. High-tension single-phase switchgear (eight panels) and one 50-K.V.A. single-phase transformer, for the U.D.C. See "Official Notices" January 17th.

Italy.—MILAN.—The scheme to electrify the tramway from Milan to Gallarate having received the sanction of the Consiglio Superiore dei Lavori Pubblici, orders for the necessary equipment may be forthwith expected.

Leeds.—February 19th. Coal and general stores for a year, for the Corporation electric lighting department. See "Official Notices" to-day.

London.—HACKNEY.—The Council will shortly be inviting tenders for the erection of three sub-station buildings and plant for same, opening ground and supplying and laying conduits, constructing draw-pits, &c., under the scheme set out in Mr. Robinson's recent report.

February 4th.—The Metropolitan Water Board is inviting tenders for Sec. 25, electric lamps and accessories, for one year. Specifications and forms of tender from the Clerk of the Board, Savoy Court, Strand, W.C.

L.C.C.—January 29th. Electrical installation at Cook's Ground Elementary School, Chelsea, S.W. See "Official Notices" January 17th.

SHOREDITCH.—The B.C. Lighting Committee will purchase 150 meters of various sizes, from 5 to 100 amperes, as required for new consumers.

HAMMERSMITH.—February 5th. General stores for a year, for the B.C. electricity department. See "Official Notices" to-day.

H.M. OFFICE OF WORKS.—February 5th. Main switches, main fuses, switch fuse and fuse boards, for three years. See "Official Notices" to-day.

BERMONDSEY.—February 17th. Stores for a year, for the B.C. Electricity Department. See "Official Notices" to-day.

Nelson.—February 3rd. One traction battery, one automatic reversible booster and switchgear, one D.C. motor-generator and switchgear, for the Electricity and Tramways Committee. See "Official Notices" January 10th.

Salford.—February 3rd. Rotary converters for the Corporation. See "Official Notices" to-day.

Sheffield.—February 5th. General stores for two years, for the City Electricity Supply Department. See "Official Notices" January 17th.

Spain.—February 8th. The Spanish Post and Telegraph authorities in Madrid are inviting tenders for the concession for the establishment and working of a telephone exchange in the town of Ceuta.

The municipal authorities of Toledo have just invited tenders for the concession for the electric lighting of the town during a period of 10 years.

Switzerland.—LUGANO.—January 31st. Tenders are required for the installation of the electric light in the Lugano Station, the works including the supply and erection of about 2,000 glow lamps and seven arc lamps, cables, lines, &c. Plans and particulars from Bureau 21, Telegrapheninspektion der Kreisdirektion, 7, der Schweizer Bundesbahn, Lucerne.

Uruguay.—March 29th. Five electric gantry cranes for Customs warehouses at Monte Video. B. of T. C.I. Department in London.

Warrington.—February 3rd. The Corporation is calling for tenders for an electric light installation at the Public Baths. Mr. A. M. Ker, borough electrical engineer.

West Ham.—January 24th. Engine-room stores, chemicals and A.C. house-service wattmeters, for the Council's electricity department. See "Official Notices" January 10th.

CLOSED.

Blackpool.—The Tramways and Electricity Committee has decided to order from the United Electric Car Co., Ltd., six open type tramcars, similar to those previously supplied.

Cape Town.—The City Council has accepted the following tenders:—

W. T. Glover & Co.—33 miles aerial braided wire, £613; 15 miles vulcanised rubber-insulated wire, £445; various lengths of paper-insulated, lead-covered and steel-armoured cable, £686.
Telegraph Manufacturing Co.—10,000 yd. 19/14 bare copper wire, £488.

Ealing.—Tenders have been received by the B.C. Electricity Committee from the following firms for a new switchboard:—

Crompton & Co., Ltd.	Siemens Bros. & Co., Ltd.
British Westinghouse Co., Ltd.	General Electric Co., Ltd.
Switchgear Co., Ltd.	British Thomson-Houston Co., Ltd.
Ferranti, Ltd.	

Their consideration has been deferred till the next meeting of the Committee, the electrical engineer being instructed to prepare a schedule and report thereon.

Glasgow.—The T.C. has accepted the following tenders:—

White lead in oil.—Herd, Hastie & Co.
Patent filling.—Craig Sharp, Ltd.
Stopping place sign-posts and brackets.—J. and A. Law, Ltd.; Walter Macfarlane & Co.
Route number plates.—P. and W. MacLellan, Ltd.
Arc lamp carbons.—General Electric Co., Ltd.
Black insulating tape.—A. Avtsine.
Pinkston fuel.—Wm. Baird & Co., Ltd.; Wm. Dixon, Ltd.; R. Addie and Sons, Ltd.
Old rails.—P. and W. MacLellan, Ltd.
Trolley cord.—W. C. Yuille & Co., Ltd.

The areas recently added to the city are to be fitted with fire alarms, in connection with which the following tenders have been accepted:—W. W. Glover & Co., Ltd., £312, for wiring; and the British Insulated and Helsby Cables, Ltd. £146, for insulators, &c.

The Electricity Committee has renewed the contract with the Tudor Accumulator Co., Ltd., for the maintenance of the battery at the Govan Electricity Works for a further period of 10 years at the rate of £202 per annum.

Gosport.—The Education Committee has accepted the tender of Mr. W. N. Walters, Gosport, for installing the electric light at the new school in Stone Lane.

Hendon.—Mr. F. R. Garrod has secured the order for electric lighting and heating at the Alexandra Club.

Government Contracts.—The following tenders have been accepted during the past month by the Government Departments named :—

WAR OFFICE.

Storage batteries.—Tudor Accumulator Co., Ltd.
Electric cable and wire.—Hooper's Telegraph and India-Rubber Works, Ltd.; London Electric Wire Co., and Smiths, Ltd.; Siemens Bros. and Co., Ltd.
Heliographs.—W. Ottway & Co., Ltd.; Siemens Bros. & Co., Ltd.
Electric lamps.—Brimsdown Lamp Works, Ltd.; Crypselco, Ltd.
Electric motors.—Lancashire Dynamo and Motor Co., Ltd.
Switchboards, &c.—British Thomson-Houston Co., Ltd.; Cox-Walters, Ltd.
Switches.—Ward & Goldstone.
Installation of electric light, &c., Fort Pitt Military Hospital, Chatham.—A. V. Gifkins & Co.
Laying cable at Royal Military College, Sandhurst.—Siemens Bros. and Co., Ltd.

INDIA OFFICE: STORE DEPARTMENT.

Cable.—Liverpool Electric Cable Co.
Magneto wall sets.—Peel-Conner Telephone Works.

CROWN AGENTS FOR THE COLONIES.

Telegraph poles.—Siemens Bros. & Co., Ltd.
Wireless telegraph apparatus.—Marconi's Wireless Telegraph Co., Ltd.

GENERAL POST OFFICE.

Telephonic apparatus.—London Electric Wire Co., and Smiths, Ltd.; Western Electric Co., Ltd.
Submarine cable.—Siemens Bros. & Co., Ltd.
Telephonic cable.—British Insulated and Helsby Cables, Ltd.; Callender's Cable and Construction Co., Ltd.; Henley's Telegraph Works Co., Ltd.; Johnson & Phillips, Ltd.; Siemens Bros. & Co., Ltd.; Western Electric Co., Ltd.
Cases for dry cells.—British L.M. Ericsson Manufacturing Co., Ltd.
Stoneware ducts.—Albion Clay Co., Ltd.
Insulators.—Taylor, Tunnicliff & Co., Ltd.
Telegraphic ironwork.—Bullers, Ltd.; Guest, Keen & Nettlefolds, Ltd.
Bronze wire.—T. Bolton & Sons, Ltd.; British Insulated and Helsby Cables, Ltd.; Shropshire Iron Co., Ltd.; F. Smith & Co., incorporated in the London Electric Wire Co., and Smiths, Ltd.
Rod zincs.—Siemens Bros. & Co., Ltd.
Power plant and wiring, Valencia Wireless Telegraph Station, Co. Kerry.—Johnson & Phillips, Ltd.
Telephone exchange equipment, Mansfield.—Peel-Conner Telephone Works, Ltd.
Extension of No. 2 Telephone Exchange, Cardiff.—The Automatic Telephone Manufacturing Co., Ltd.
Extensions to Central Telephone Exchange, London, E.C.—Western Electric Co., Ltd.

Ipswich.—The Dock Commission has accepted the tender of Messrs. Ransomes & Rapier, Ltd., for an electric travelling crane, at £1,300.

London.—L.C.C.—The Highways Committee received tenders as under for about 3½ miles of grooved trolley wire required for the overhead tramways system :—

		Per mile. £ s. d.
T. Bolton & Sons, Ltd.	(accepted)	109 4 0
B.I. and Helsby Cables, Ltd.		112 11 6 (less 2½ %)
Thompson & Co.		116 0 0

For the supply of 3,000 pairs of tramway rail fish-plates the offers received were :—

		Per ton. £ s.	Total. £
Cammell, Laird & Co., Ltd. ..	(accepted)	9 15	780
Walter Scott, Ltd.		12 10 ..	969
Alfred Clare & Co.		24 10 per bar (or 17s. 6d. a joint)	2,621

Messrs. Elliott Bros. are to supply 17 instruments for testing magnetic brake coils, at £10 11s. 6d. each.

The Stores and Contracts Committee recommends that contracts with the following be approved :—

Electric fittings.—Accles & Pollock, Ltd.; British Westinghouse Electric and Manufacturing Co., Ltd.; Elliott Bros.; and General Electric Co., Ltd.

The Stores and Contracts Committee reports having accepted tenders as under during the recess :—

Electric fittings.—Atlas Carbon and Battery Co., Ltd.; B.I. and Helsby Cables, Ltd.; Cooper & Roberts; Dorman & Smith; Edison & Swan Co.; Electrical Manufacturing and Supplies Co.; Elliott Bros.; W. Geipel & Co.; General Electric Co., Ltd.; Hart Manufacturing Co.; W. McGeoch & Co., Ltd.; A. Round; Veritys, Ltd.; W. White & Co.
Machine belting.—J. Hendry; Hepburn, Gale & Ross, Ltd.

SHOREDITCH.—The B.C. Lighting Committee, following a report by the electrical engineer on experiments with new type flame lamps, recommends the purchase of 48 "Metroflam" arc lamps (70-80 hours) from Messrs. Johnson & Phillips, Ltd., and 48 "Angold" arc lamps (90 hours) from the General Electric Co., Ltd., the total cost being £936. The great increase of vehicular, especially motor, traffic necessitates improved lighting of the main thoroughfares without delay, and the adoption of the above lamps will give a greater illuminating power by nearly 100 per cent. as compared with the existing 12½-ampere, 1,500-C.P. lamps. The new type of lamp, for one-third less current, 8 amperes, gives 2,500 C.P., "and has in addition a better fog-penetrating effect." It is estimated that the saving per annum on a circuit of 24 lamps, including current and attendance, after allowing for the slight increase in the cost of carbons, will be about £124. The first cost of the new lamps will be covered in less than two years. The work will not be commenced until the close of the financial year.

For the supply of lead-covered, paper-insulated service cables, the Committee recommends the acceptance of the tender of Messrs. Siemens Bros. & Co., Ltd., the lowest submitted, as under :—1 mile 7/16, £70; ½ mile 7/14, £90 per mile; ½ mile 19/16, £133 per mile; ¾ mile 19/14, £187 per mile.

BATTERSEA.—The B.C. has decided to renew its contract with Callender's Cable and Construction Co., Ltd., for the supply of cables, &c., for a further period of one year.

Salford.—The Guardians have accepted the tender of Messrs. Willoughby & Willcox for the installation of electric light and bells at the new offices (£142), and the tender of Mr. Gilbert Matthews for provision of electric fittings for board room, laundry and clerk's office (£25).

Stockport.—The T.C. has accepted the tender of Lord Vernon for Warsop and Poynton slack coal for the electricity works at 10s. 10d. per ton; and that of Mr. John Faulkner, of Manchester, for a lightning conductor, at £10 15s.

FORTHCOMING EVENTS.

British Electrical and Allied Manufacturers' Association. Friday, January 24th. At 7 for 7.30 p.m. At the Savoy Hotel. Dinner.

Royal Institution.—Friday, January 24th. At 9 p.m. Discourse on "Recent Advances in Scientific Steel Metallurgy," by Prof. J. O. Arnold.

Thursday, January 30th.—At 3 p.m. Lecture on "Recent Research on the Gas Engine," by Prof. B. Hopkinson. (Lecture I.)

Physical Society.—Friday, January 24th. At 5 p.m. At the Imperial College of Science, South Kensington. Papers on "The Electrical Conductivity and Fluidity of Strong Solutions," by Mr. W. S. Tucker; "The Resistance of Electrolytes," by Messrs. S. W. J. Smith and H. Moss; and "The Recalescence of Iron Carbide," by Messrs. S. W. J. Smith and J. Guild.

Junior Institution of Engineers.—Saturday, January 25th. At 11 a.m. Visit to the Houses of Parliament for inspection of heating, ventilation, &c.

Friday, January 31st.—At 8 p.m. At the Great Eastern Hotel, E.C. Institution smoking concert.

Royal Society of Arts.—Monday, January 27th. At 8 p.m. Cantor lecture on "Liquid Fuel," by Prof. V. B. Lewes. (Lecture II.)

Institution of Electrical Engineers (Newcastle Students' Section).—Monday, January 27th. At 7.30 p.m. At the Armstrong College, Newcastle. Paper on "The Application of Electricity to the Lighting of Residences, Business Premises and Factories," by Mr. S. I. Ellis.

(Manchester Section).—Tuesday, January 28th. At 7.30 p.m. At the University, Manchester. Paper on "The Use of a Large Lighting Battery in connection with Central Station Supply," by Mr. H. F. Whysall.

(Yorkshire Section).—Wednesday, January 29th. At 7 p.m. Meeting at the University, Sheffield.

(Students' Section).—Wednesday, January 29th. At 7.45 p.m. At the Institution. Paper on "The Conditions Influencing the Design and Minimum Manufacturing Cost of Induction Motors," by Mr. E. T. Driver.

Institution of Civil Engineers.—Wednesday Evening, January 29th. Students' visit to the Edgware Road-Paddington extension of the London Electric Railway.

The Electrical Engineers' Ball.—Friday, January 31st. At 9 p.m. Hotel Cecil, London.

THE ELECTRICAL ENGINEERS
(LONDON DIVISION).

Commanding Officer—LIEUT.-COL. H. M. LEAF.

The following orders have been issued for the current week :—

Monday, January 27th.—"A" Company. Recruit training, 7 to 10 p.m. company training, 7 to 10 p.m.

Tuesday, January 28th.—"B" Company. Recruit training, 7 to 10 p.m.; company training, 7 to 10 p.m.

Thursday, January 30th.—"C" Company. Company training, 7 to 10 p.m.

Friday, January 31st.—"D" Company. Recruit training, 7 to 10 p.m. company training, 7 to 10 p.m.

Saturday, February 1st.—"B" Company. Week-end run at Fort Coalhouse, East Tilbury. Parade at Fenchurch Street Station at 3 p.m., for train leaving at 3.25 p.m. Dress:—Service dress, putties and greatcoats. No arms will be taken.

"A" Company. A lorry run will take place this day. The lorry crew will parade at Headquarters at 2.30 p.m. Dress:—Service dress, putties and greatcoats. No arms will be taken.

Headquarters will be opened for regimental business only from 10 a.m. till 12 noon.

(Signed) P. H. CAMPBELL, Capt. R.E., and Adjt.,
For Officer commanding L.E.E.

The Lighting of Factories and Workshops.—It is announced that the Home Secretary has appointed a Committee to inquire and report as to the conditions necessary for the adequate and suitable lighting (natural and artificial) of factories and workshops, having regard to the nature of the work carried on, the protection of the eyesight of the persons employed, and the various forms of illumination. The members of the Committee are :—Dr. R. T. Glazebrook, Director of the National Physical Laboratory (chairman); Mr. L. Gaster, Prof. Francis Goteh, Mr. J. Herbert Parsons, Mr. W. C. D. Whetham, and Sir Arthur Whitelegge, Chief Inspector of Factories. The secretaries of the Committee are Mr. D. R. Wilson, one of His Majesty's Inspectors of Factories, and Mr. C. C. Paterson, of the National Physical Laboratory. Any communications on the subject of the inquiry may be addressed to Mr. D. R Wilson, at the Home Office. —The *Times*.

NOTES.

Parliamentary Notes.—Admiralty Contracts.—Mr. Barnes, on January 15th, asked the First Lord of the Admiralty whether, in connection with the strike of electrical workers on the Clyde, he could state the result of the inquiry into the alleged violation of the fair-wages clause by the Government contractors in employing apprentices to perform electrical work instead of fully qualified men at the proper rates of wages; and whether the Admiralty was satisfied that no breach of the clause had been made to the benefit of the employers and the prejudice of the workmen. Dr. Macnamara replied that as the result of the inquiry, it appeared that during the progress of certain work to complete the *New Zealand*, the electricians of the district struck work with a view to obtaining an additional ½d. an hour in their rate of wages. It was understood that the Fairfield Co. offered to concede this demand so far as the men engaged on this ship were concerned, in order to avoid interruption in the work, but that offer was declined in the absence of a similar concession throughout the district. The ship had already been delayed, and it was important that there should be no further delay. The company, therefore, employed 14 apprentices to do the work, eight of whom were in their fourth or fifth year, and five in their third year. No boys were employed all night after having worked during the day, and only some of the older apprentices employed during the day were allowed to work overtime up to 9.30 p.m. The whole of the work so carried out was finished and tested to the entire satisfaction of the Admiralty representatives. In all the circumstances the Admiralty did not consider it necessary to take any further action in the matter.

Post Office Electric Lighting Department.—In Tuesday's Parliamentary Papers, Mr. Barnes asked the Postmaster-General if engineers in the electric lighting department were paid overtime rates, in accordance with the conditions accepted, and generally observed, by the employers and employed; and if they were paid for Sundays and Christmas Day, in accordance with such conditions; namely, were they paid one and a quarter time for the first two hours, one and a half for time after that, excepting the days mentioned, and for those were they paid at the rate of double time? Mr. H. Samuel replied that the honourable member presumably referred to the minor grades of the electric light staff, *i.e.*, shift officers, circuitmen, enginemen, &c. Such men received overtime pay at rate and a quarter on weekdays, and rate and a half for duty in excess of the scheduled attendance on Sundays. Scheduled duty on Sunday was not specially remunerated, as the Post Office scale of pay covers 50½ hours' scheduled attendance on any six days out of the seven. A few men in London, originally employed under factory conditions, retained the privilege of payment for overtime at rate and a quarter for the first two hours, and then at rate and a half, with double rate for duty in excess of the scheduled attendance on Sundays. Extra duty performed on Christmas Day was paid for at Sunday extra duty rates.

E.T.B.I.—The whist drive recently mentioned in our pages was held on Friday, January 17th, at Slater's Restaurant, 50, Cannon Street, E.C. The main object of the entertainment was to endeavour to get the members of the staffs of some electrical firms to take an interest in the Institution. It was primarily organised amongst the members of the staffs of the General Electric Co., Sterling Telephone and Electric Co., Ltd., and the Union Electric Co., but, in addition, other ladies and gentlemen came, there being 128 players, in addition to the members of the Committee, &c. The Committee consisted of Mr. Champion (Union Electric Co.), Mr. Crow (Sterling Telephone and Electric Co.), Mr. Williams (General Electric Co.) and the secretary of the Electrical Trades Benevolent Institution. Mr. Crow was elected to be the M.C., and he carried out his duties to everyone's satisfaction, the full programme being completed and the prizes distributed on the stroke of 11 o'clock. The other members of the Committee worked extremely hard, with results which were most thoroughly satisfactory. Immediately after the interval a short address was given by the secretary, Mr. Hawes, dealing in a full and informing way with the essential features of the Institution, its objects, &c., and answering the statements that were sometimes made to the effect that the Old Age Pensions and the National Insurance Act were reasons for not troubling to support the Benevolent Fund. The prize fund was subscribed to by the following:—General Electric Co., Mr. Guy Burney, Mr. Justus Eck, Mr. F. B. O. Hawes; and the prizes were kindly given away by Mrs. Ritchie.

Miners' Lamps.—According to the *Times*, the Home Secretary has approved, under Sec. 33 of the Coal Mines Act, 1911, the Hailwood lamp No. 1, and the Oldham emergency electric lamp, the latter only for use in time of accident or by officials, for use in all mines to which the Act applies. Copies of the approving order containing specifications of the lamps will shortly be issued by the Government printers.

Will.—The *Daily Mail* states that the late Mr. W. Bottomley, of Glasgow, one of the first directors of Messrs. Kelvin and White, Ltd., and for many years assistant to Lord Kelvin in his scientific work, left £3,788 personal estate.

Aluminium.—A neat little booklet setting forth the leading properties of aluminium and the various forms in which it is supplied has been issued by the British Aluminium Co., Ltd., who will send copies to any readers who use the metal. Electrical data are included, and the information will be useful to engineers, draughtsmen and others interested in the subject.

British Tramway Statistics.—A Board of Trade return of the finance and traffic of British tramways for 1911-12 contains the following particulars:—

	1910-11.	1911-12.
Miles open	2,597	2,637
Cars running	12,709	12,944
Miles run by cars	310,494,243	323,354,389
Passengers carried ...	2,907,477,120	3,127,318,732
Electrical units used ...	516,241,612	548,695,979
Gross receipts	£13,777,001	£14,726,068
Working expenditure ...	£8,500,941	£8,924,420
Net receipts	£5,276,060	£5,801,648
Relief of rates	£370,435	£488,509
Aid from rates	£68,055	£62,132

Of the 290 undertakings, 172 belong to local authorities and 118 to companies or individuals. Local authorities made a net profit of £4,233,874 on the year's traffic, out of which, in addition to setting aside £488,509 in relief of rates, they applied £1,247,908 towards the reduction of tramway debt and carried £975,504 to reserve and renewal funds. In the cases of three local authorities and six companies, the returns show an excess of working expenditure over gross receipts.

Association of Electrical Station Engineers.—An informal meeting was held on Thursday, January 16th, at 69, Fleet Street, E.C. Twenty-one representatives of electrical stations attended. A report was made on the enormous amount of correspondence received, in reply to an announcement in the Electrical Review. It was stated that the general opinion of the correspondents was that a business-like "Association" should be formed immediately, and that practically the whole of the technical staffs of the undertakings they represented would become members. Previously to January 14th prospective members numbered well over 500, but as a large amount of correspondence containing names of prospective members has been received since the above date, the number has probably reached 1,000. After lengthy discussions, several resolutions were passed, details of an application form were agreed to (which is to be printed at once), and the next general meeting was arranged for February 6th, 1913. The following resolutions were passed:—

1. That the Association be called "Association of Electrical Station Engineers."

2. That the objects of the Association be—

To raise the efficiency and general status of members of the Association.

To provide means for social intercourse among its members, for their improvement, advancement, and recreation.

To form an information bureau for the general assistance of members and employers.

3. That the essential qualification for membership shall be that the prospective member must be qualified for, and hold a responsible position in, an electrical undertaking for power, lighting or traction.

4. That a chartered accountant be approached to take charge of the finances of the "Association."

5. That all announcements with regard to the "Association" be advertised in the Electrical Review.

Mr. W. J. Ebben was elected hon. secretary.

Motor-'Bus Obstruction of Tramcar.—At the Greenwich Police Court last week, W. F. Gilbert was fined 10s. and 23s. costs for wilfully interfering with the London County Council tramway traffic at New Cross Road. Mr. Greenwood, for the L.C.C., said (as reported in the *Standard*) that the case was one of importance to the public who used tramways and motor-omnibuses. The defendant was a driver in the service of the L.G.O. Co. The evidence would show that the motor-omnibuses were not content to go in for fair play; they wanted all the passengers.

Arthur Dunn, conductor of the tramcar, said that on November 9th his car drew up at the "island" at New Cross Gate. The defendant's motor-omnibus pulled up close to the tramcar, the front of the omnibus being close to the step which passengers used to get on and off his car, a very small space being left for people to alight or join the car. The front of the omnibus was practically level with the step of the car, and people would have had to pass in front of the omnibus to get to the car. People waiting on the "island" could not reach his car, and he had to go on and leave them. The defendant declared that the London County Council really obstructed him. The Board of Trade regulation was that when one vehicle came up the one in front should proceed. There was not room for a tramcar and an omnibus, and he could not avoid his omnibus partly covering the step of the car. The car stopped so suddenly that he could not do otherwise.

Shock Accident Claim.—The *Glasgow Daily Herald* states that some time ago an action was raised in Paisley Sheriff Court against the Paisley District Tramway Co., for damages in connection with an accident which occurred to a boy who was travelling on one of the company's cars. The boy was barefooted, and was seated on the top near the metal pillar which supports the trolley-pole. The record in the case stated that through defective insulation, or some other cause, the metal pillar became charged with electricity, with the result that when the boy's naked foot touched it he received a severe shock, with serious and painful injuries from burning. In consequence of his injuries the boy was laid up for six weeks. The company has now offered a satisfactory sum in full settlement, which has been accepted, and the action will be taken out of Court by joint minute.

Accidents.—JOHANNESBURG.—Our Cape correspondent writes:—"At the Bantjes distributing station of the Victoria Falls Power Co. an explosion of an oil switch recently caused serious burning injuries to two engineers. In the first place, one of the feeder switches tripped, and whilst an assistant engineer named Davis was telephoning to the company's control department to report the occurrence another oil switch exploded. The explosion burst open the iron doors between the operating passage and the switch passage. Flames passed into the operating passage, and Davis was severely burnt about the face and hands. A probationer named Jones was also burnt, but to a less degree. The cause of the explosion is believed to be lightning on the transmission line, which caused the first switch to trip and fire the oil. This caused a short-circuit, which in turn caused the explosion of the second oil switch."

MOTHERWELL.—Hugh Bird, electrical fitter, of Motherwell, while working at an electrical crane, was seriously injured by being jammed between the carriage and an iron box.

According to a Glasgow paper, Adam Sommerville, a young electrical engineer, was removed to the Western Infirmary, Glasgow, suffering from injuries sustained while at work in Messrs. Hurst, Nelson & Co.'s wagon works, Motherwell. He was passing a machine when he became entangled in the belt, and was thrown violently to the ground.

Educational Notes.—A special series of lectures on Illuminating Engineering is now in progress at the Polytechnic, Regent Street. The first section of the course, dealing with gas, electric, acetylene and air gas lighting, &c., has now been concluded. On Friday, January 17th, the first lecture of the second half of the course, dealing with illumination and the eye, was delivered by Dr. W. J. Ettles. The remaining five lectures, commencing to-day, are to be given by Mr. J. S. Dow, and will deal with practical applications, including such questions as the measurement of light and illumination, colour, shades and reflectors and indoor and outdoor illumination.

Prof. Stephen H. Dixon, Professor of Civil Engineering in the University of Birmingham, has accepted an invitation to give a special course of lectures in Municipal engineering at University College during the current term. The course was to begin on Tuesday last, at 4 p.m.

The Thames Ironworks.—The appeal of Mr. Arnold F. Hills against Mr. Justice Eve's order of December 20th last, for the immediate closing of the works, was, on Saturday, dismissed by the Court of Appeal.

Tramway Social.—On 15th inst., the ninth annual tea and social of the Gateshead and District Tramway Co.'s employés was held at the Parish Hall, Rawling Road, Gateshead, the number present, including ladies, being 150. Mr. W. Morrison, the general manager, made a brief speech, and, in addition to referring to the friendly relations existing between the company and its employés, he mentioned that the employés' Benevolent Society's funds stood at the satisfactory figure of £204. A programme of music and song followed.

Denial.—Messrs. Loxley & Co., Ltd., of Leeds, write as follows:—"We have recently heard that rumours are going about that we have obtained an order for electric wiring of the Bordesley Post Office, Birmingham. We wish to deny this absolutely, as we do not quote for electric wiring."

Marconi Litigation.—In the King's Bench Division Mr. Justice Scrutton has had before him for several days this week the action of Marconi's Wireless Telegraph Co., Ltd., *v.* Goukassoff and Tischenko, in which plaintiffs claim damages for breach of contract in respect of an option for sale of shares in the Russian company. On Wednesday his Lordship said that he would give judgment to-day (Friday), but it would be against the defendants for damages, but the amount of the latter would be affected if in the meantime a sufficient number of shares were put under the control of plaintiffs. In another case plaintiffs also claimed damages against one Baruch for having maliciously induced the above defendants to break their contract with the plaintiffs. Judgment was given for the defendant.

The Alklum Accumulator.—Referring to the paragraph in our last issue on the new electric storage battery brought out by Messrs. Worsnop & Co., Ltd., of Halifax, we learn that one of its features is that no acid or lead is used in its construction. As its name, "Alklum," implies the fluid employed is of an alkaline nature. Its chief component is nickel, while the containing case is of welded steel. It is claimed that the electrodes and electrolyte are practically permanent, as the liquid is unvariable and only requires making up with distilled water, while the electrodes consist of insoluble material carried in nickel cages. It is further claimed that the cells cannot be overcharged, and that they may remain uncharged for long periods without damage, while jarring and jolting do not affect them. We have seen a charging and discharging curve of the new batteries, which shows that the discharge is not only extremely gradual, but that it maintains its voltage almost to the end. Specimens of the Alklum accumulators can, we understand, be inspected at the depôt of the Motor Lighting Co., 13, Panton Street, Haymarket, London, S.W.

A Lambeth Lift Contract.—In connection with applications invited by the Lambeth Board of Guardians for tenders for the installation of two electric lifts at the Infirmary, Brook Street, and another at the Workhouse, Renfrew Road, the following firms sent prices and specifications. The figures represent the price quoted for installing the three lifts, for the two lifts at the Infirmary, and for the one at the Workhouse only, respectively. At a meeting of the sub-Committee on Wednesday last, the tender of Messrs. Waygoods, Ltd., Falmouth Road, S.E., was accepted.

Aldous & Campbell, Ltd.—£1,450 (17 weeks), £950 (12 weeks), £500 (10 weeks).

Easton Lift Co.—£1,689 (12 weeks), £1,145 (12 weeks), £544 (10 weeks).

Lift and Hoist Co.—£1,524 (16 weeks), £1,020 (16 weeks), £480 (16 weeks).

Medway's Safety Lift Co.—£1,690 (16-18 weeks), £1,107 (12-13 weeks), £583 (16-18 weeks).

Otis Elevator Co.—£1,845 (10-12 weeks), £1,255 (10-12 weeks), £590 (10-12 weeks).

A. W. Penrose & Co.—£1,428 (15 weeks), £948 (14 weeks), £480 (14 weeks) with extras.

Scholey & Co., Ltd.—£1,593, £1,100, £493.

Smith, Major & Stevens.—£1,610 (15 weeks), £1,120 (13 weeks), £520 15s. (11 weeks).

W. Wadsworth & Son, Ltd.—£1,486 (20 weeks), £1,006 (12 weeks), £480 (eight weeks).

Waygoods, Ltd.—£1,566 (15 weeks), £1,034 plus 5 per cent. if divided (12 weeks), £532 plus 5 per cent. if divided (—).

Institution and Lecture Notes.—ASSOCIATION OF MINING ELECTRICAL ENGINEERS (WEST OF SCOTLAND BRANCH).—The monthly meeting of the Branch was held on January 18th, when discussion was resumed on the papers read by Mr. Campbell King on "The Electrification of a Group of Small Collieries," and by Mr. S. A. Simon, Glasgow, on "Speed Control of Three-phase Motors."

INSTITUTION OF ELECTRICAL ENGINEERS (SCOTTISH LOCAL SECTION).—On January 14th, Messrs. J. S. Nicholson and B. P. Haigh read their paper on "A Single-Phase Motor with Pole-Changing Windings," before the Scottish Local Section at Glasgow, and a discussion followed.

Mr. Halley Craig said that if the authors' work had been done a long time ago there would have been a change in the methods which would have put electricians 20 years in advance of where they now were.

The Chairman said that when they were arranging for the first Electric Lighting Bill, people were very much astonished when Mr. Ferranti announced that he had an alternating motor up his sleeve; they could not believe that.

The members were afterwards conducted over the laboratory, where the motor was exhibited in motion.

Introducing a discussion on the "Mathematical and Scientific Training of Engineers" at a meeting of the WESTERN BRANCH OF THE ASSOCIATION OF SCIENCE TEACHERS OF SCOTLAND in Glasgow on 18th inst., Mr. Henry Mavor argued that mathematics was absolutely essential to the study and understanding of science in every stage of its development. The German educational practice in this respect was compared to our own, to the discredit of the latter, but he thought it was unwise to push the comparison as far as it was often done. The Germans were certainly ahead of us in some special branches of knowledge and industry, but as certainly were not ahead of us as a whole. In electrical affairs, for instance, few inventions were German. His concrete opinion was that the whole training of an engineer must be founded upon the fact that he was an engineer actually engaged in the work of construction in the workshop.

A paper on "Electrical Locomotives for Main Line and Suburban Services" was read at a meeting of the Scientific Society of the Royal Technical College, Glasgow, on Saturday last by Mr. B. P. Haigh, of the Engineering Department of the University of Glasgow.

Damaging an Electric Meter.—At Newton Abbot, South Devon Petty Sessions on Tuesday, Wm. Ireland Islesworth was bound over to be of good behaviour for six months and ordered to pay 16s. 6d. costs, for damaging a meter belonging to the Newton Urban Electric Supply Co., Ltd. Defendant tampered with the meter, and abstracted 6s. from it, but the charge of larceny was not gone into. "I fancy it would be a funny thing," said the defendant, "if I wanted to rob the meter, that I should take out 6s. and leave 11s. behind." Mr. Hitchings, solicitor to the company, said "that is an old trick."

Appointments Vacant.—Electrical engineer and manager, for the Wolverhampton Corporation (£600); meter tester, for the Shanghai Municipal Council Electrical Department (£21 per month); electrical engineer, for the Burgh of Wishaw; charge engineer, for the Wakefield Corporation Electricity Department (35s.); switchboard attendant for the Newport (Mon.) Electricity Department (25s.). See our advertisement pages in this issue.

Inquiries.—A correspondent asks for the names "of firms supplying a complete line in wiring accessories designed for open wiring with ordinary flexible." Makers of brushes for electrically-driven boot-cleaning machines are asked for.

OUR PERSONAL COLUMN.

The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the ELECTRICAL REVIEW *posted as to their movements.*

Central Station Officials.—Owing to the appointment of MR. J. M. DAWSON, who for the last 7 years has been engineer-in-charge at the electricity works, formerly of the Hanley Town Council, and now of the Stoke-on-Trent Town Council, to the position of engineer-in-chief of the Bethnal Green Board of Guardians, London, a vacancy was created on Mr. Yeaman's staff, and as the new power house will shortly be running, two appointments were made from the selected candidates, namely, MR. F. HURST, who was charge engineer in the Runcorn generating station of the Mersey Power Co. (as already announced here), and MR. A. MCKAY KISSACK, who was erecting engineer for the British Westinghouse Co., Ltd.

MR. JAMES FORSYTH, shift engineer, Motherwell Corporation electricity works, has resigned and taken up similar duties at the Poplar electricity works. MR. SLADE, of London, takes up duties as shift engineer at Motherwell.

The Swinton and Pendlebury U.D.C. has fixed the salary of the electrical engineer, MR. H. C. BUSBRIDGE, at £161 per annum, from December 1st, the date of his appointment.

MR. ERNEST MARKS has been permanently appointed to the position of meter tester to the Islington undertaking.

MR. K. S. NEBEL has resigned his position with Messrs. Mather and Platt, Ltd., Manchester, in order to take up an appointment in Berlin.

The Aldershot U.D.C. has increased the salary of MR. F. H. EBERL, first assistant at the electricity works, to £130 per annum.

MR. W. H. TUNNICLIFFE, of the Salt Union (Mersey Power Co.), Runcorn, has been appointed junior shift engineer at the Rotherham Corporation electricity works.

The Stepney B.C. Electricity Committee has recommended that the salary of the borough electrical engineer and manager be increased from £750 to £800 per annum, and by an additional £50 on January 1st, 1914.

Tramway Officials.—The Oldham Tramway Committee has recommended the Council to grant an advance from £350 to £400 per year in the tramway manager's salary.

General.—MR. GRAHAM MONTAGUE, of Bristol, consulting engineer and surveyor, announces that, having accepted an appointment as engineer to the Egyptian Government P.W.D., he intended sailing yesterday for Cairo, and that all correspondence should be addressed to him care of Public Works Ministry, Cairo, Egypt.

Owing to pressure of business, MR. J. MOULD has found himself obliged to resign the hon. secretaryship of the I.E.E., Students' Section, and MR. GEO. W. P. PAGE has been elected to the position.

MR. J. J. CHISWELL has resigned the position of sales manager with the Brimsdown Lamp Works, Ltd., as from December 31st last.

The engagement is announced of MR. BRIAN CROSSLEY, youngest son of the late Sir Wm. Crossley, Bart., to Margaret Lilian, elder daughter of Mr. J. W. Sidebotham, of Bowdon, Cheshire.

MR. JOHN COATES, M.Inst.C.E., senior partner of the firm of John Coates & Co., Ltd., of Westminster, has been appointed to carry out the work of the inspection of material purchased for the Commonwealth railway construction and rolling stock in connection with the Australian Trans-Continental Railway.

It is stated in the *Times*, that SIR W. B. FORWOOD, in consequence of continued ill-health, has resigned the chairmanship of the Liverpool Overhead Railway, and MR. HARVEY CECIL WOODWARD has been appointed in his place.

The *Financier* states that MR. C. N. MURPHY has joined the board of Universal Cheap Cables, Ltd.

According to the *Times*, the Postmaster-General has appointed MR. J. J. KENNY, of the Dublin Telegraph Office, to be Controller of that office in succession to Mr. Michael O'Toole, who has retired.

Obituary.—MR. T. THOMPSON.—The death has taken place at Cleckheaton (Yorks.), of Mr. Thos. Thompson, late of Dundee, who was for upwards of 34 years the Scottish representative of Messrs. Edward Green & Sons, Ltd., of Wakefield and London. He was 74 years of age.

HERR W. BRAUN.—The death is announced from Frankfort-am-Main, of Herr Wunibald Braun, one of the founders of the electrical engineering firm of Messrs. Hartmann & Braun.

NEW COMPANIES REGISTERED.

Vickstow Cars, Ltd. (126,511).—This company was registered on January 14th, with a capital of £12,500 in £1 shares, to carry on the business of manufacturers of and dealers in motor-cars, lorries, petrol-electric motors, oil and gas engines, electrical machinery, flying machines, cycles, &c. The subscribers (with one share each) are:—I. M. Henderson, 2, Moorgate Street Buildings, E.C., chartered accountant; W. J. Bristow, 39, St. James' Street, S.W., automobile engineer. Private company. The number of directors is not to be less than three or more than seven; the first are I. M. Henderson (chairman), N. H. Brandon, C. L. Lowe and F. W. Balmer; qualification, 100 shares; remuneration, £250 each per annum and a percentage of the profits. Registered office, 69, Basinghall Street, E.C.

General Telautograph Co., Ltd. (126,527).—This company was registered on January 15th, with a capital of £1,000 in £1 shares, to carry on the business of manufacturers of, and dealers in, telewriters, telautographs and other apparatus, dynamos, lamps, wires, cables, insulating materials, accumulators, &c., and to adopt an agreement with the Gray European Telautograph Co., the International Telautograph Co., the Gray National Telautograph Co. and the National Telewriter Co., Ltd., for the acquisition of certain patents and rights relating to an invention known as the Telautograph or Telewriter. The subscribers (with one share each) are:—E. B. Ellice-Clark, 2, Palace Court, W., civil engineer; P. B. ———, 35, Queen Victoria Street, E.C. Private company. The first directors (to number two) are T. Birnbaum (nominated by the Gray European Telautograph Co., the International Telautograph Co. and the Gray National Telautograph Co.), and Sir J. G. Craggs (nominated by the National Telewriter Co., Ltd.); remuneration according to profits. Registered office, 20, Bucklersbury, E.C.

Strode & Co., Ltd. (126,543).—This company was registered on January 15th, with a capital of £20,000 in £1 shares (5,000 preference), to carry on the business of mechanical, electrical, hydraulic and general engineers and contractors, &c., to take over the business carried on at 3 and 4, St. Paul's Churchyard, E.C., and 48, Osnaburgh Street, N.W., as "Strode and Co.," and to adopt an agreement with D. M. Strode and G. W. Strode. The subscribers (with one preference share each) are:—D. M. Strode, 48, Osnaburgh Street, N.W., engineer and contractor; G. W. Strode, 48, Osnaburgh Street, N.W., engineer and contractor. Private company. The number of directors is not to be less than two or more than five; the first are D. M. Strode (chairman), G. W. Strode and A. E. Cumberbatch, each of whom may retain office while holding 100 ordinary shares. Registered office, 48, Osnaburgh Street, N.W.

International Power and Light Trust, Ltd. (126,531).—Registered January 15th, by Ashurst, Morris, Crisp & Co., 17, Throgmorton Avenue, E.C. Capital £10 in £1 shares. Objects: To carry on the business indicated by the title. In the event of the whole of the shares not being subscribed by March 31st, 1913, the company shall be dissolved. The signatories (with one share each) are:—J. A. Fuller, 110, Sirdar Road, Wood Green, N., clerk; J. H. Chapman, 28, Albanore Crescent, Lewisham, S.E., clerk. Private company. Table "A" mainly applies.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

British Ever-Ready Electrical Co., Ltd.—A memorandum of satisfaction in full on December 31st, 1912, of debenture dated April 5th, 1904, to July 23rd, 1907, securing £7,500, has been filed.

English Electrical Co., Ltd. (112,639).—Capital £5,000, in £1 shares. Return dated March 8th, 1912; 526 shares taken up; £526 paid; mortgages and charges, £10,000.

Lamplough & Son, Ltd.—Mortgage on the company's undertaking and property, present and future, including the uncalled capital, dated January 4th, 1912, to secure £700. Holders: Charles Hoare & Co., 37, Fleet Street, E.C.

Lichtenfield Burglar Alarm, Ltd. (112,522).—Capital £3,000 in £1 shares. Return dated December 18th, 1912 (filed December 19th). 1,710 shares taken up. £1 per share called up on 1,210. £1,210 paid. £500 considered as paid. Mortgages and charges: Nil.

South London Electric Supply Corporation, Ltd.—Issue on January 7th, 1913, of £5,170 debentures, part of a series of which particulars have already been filed.

Delagoa Bay Development Corporation, Ltd. (76,099).—Capital, £166,300 in 10s. shares. Return dated November 14th, 1912. 267,400 shares taken up. 10s. per share called up on 177,400. £88,740 paid, including £40 on 100 shares forfeited. £45,000 considered as paid on 90,000 shares. Mortgages and charges: £137,100.

Nairobi Electric Power and Lighting Co., Ltd.—Particulars of £2,000 6 per cent. fourth mortgage debentures, created December 4th, 1912, filed pursuant to Sec. 93 (3) of the Companies' (Consolidation) Act, 1908; the whole amount being now issued. Property charged: The company's undertaking and property, present and future, including uncalled capital, but excluding certain specified exceptions. No trustees.

CITY NOTES.

City and South London Railway Co.—The accounts for the half-year to December 31st show a balance after providing for the debenture stock interest, the payment of the dividend on the 5 per cent. preference stocks, 1891, 1896, 1901 and 1903, and the transfer to the renewal fund of £1,500, sufficient to allow the payment of a dividend on the consolidated ordinary stock at the rate of ½ per cent. per annum, carrying forward £2,588. The dividend for the corresponding period last year was at the rate of 1½ per cent. per annum, carrying forward £2,814.

Liverpool Overhead Railway Co.—The directors recommend the payment of dividends at the rate of 5 per cent. per annum on the preference shares, and 2½ per cent. per annum on the ordinary shares for the half-year ended December 31st last.

Nairobi Electric Power and Lighting Co., Ltd.—An interim dividend at the rate of 6 per cent. on the cumulative preference shares, in respect of the years 1906 and 1907, is to be paid.

Metropolitan District Railway Co.—The directors announce a dividend at the rate of 2 per cent. per annum on the second preference capital. £10,000 is being placed to renewals account, and £8,500 carried forward, as compared with £2,000 last year.

Montreal, Light, Heat and Power Co.—The directors have declared a dividend of 2¼ per cent. on the paid-up capital stock, being at the rate of 9 per cent. per annum, for the quarter to January 31st.

Lanarkshire Tramways Co.

THE directors' report for the half-year ended December 31st, 1912, says that the revenue was £41,910, and the expenses were £22,190, leaving £19,720. From this the following are deducted :—Contributions payable to local authorities, £852 ; interest on debentures, £909 ; interest account, £531 ; expenses in connection with Lanark County Tramways Act, £818 ; amounts written off, as per revenue account, £137 = £3,246 ; leaving £16,474, plus £5,200 brought forward, making a balance of £21,674. Of this amount £9,500 has been placed to reserve for depreciation, and the balance is to be disposed of as follows :—£10,290 to dividend at the rate of 6 per cent. per annum for the half-year on the issued share capital ; £307 to directors (being 10 per cent. of net profits after payment of 5 per cent. dividend) ; £1,577 to revenue new account. The traffic receipts show an increase of £1,890, and the expenses an increase of £1,947, as compared with the corresponding half-year of 1911. The increase in expenses was mainly due to the enhanced price of coal, heavier charges for maintenance of permanent way and for local rates, and to the additional charge created by the National Insurance Act. The directors have transferred £9,500 to reserve for depreciation. Interest has also been credited to the reserve, making a total contribution for the year of £11,448. A dividend for the half-year at the rate of 6 per cent. per annum is recommended, making 5¾ per cent. for the year. The company's action against the Lanark County Council to restrain the Council from utilising, for the purpose of building a new road known as Coronation Road, at New Stevenston, part of the £7,500 paid by the company to the County Council under the order of 1903 for road widenings, was successful. The County Council intended appealing, and at its request the matter has been arranged on satisfactory terms. The Lanark County Council will shortly proceed with the construction of tramways from Uddingston to Bellshill, Mossend and New Stevenston, to connect up with the company's lines. These new lines will be leased to the company under the agreement referred to in the directors' report for June 30th, 1912. The expenses in connection with the Lanark County Tramways Act, £818 have been written off. It is the company's intention to shortly inaugurate a service of motor-omnibuses. During the past year 10 additional debentures of £50 each have been issued. A further amount of £4,987 was invested during the half-year in trustee securities.

Half-year ended.	Gross profit.	Dividends.	Miles open.	Passengers carried.	Traffic receipts.	Av'r'ge fare.	Car-mil'ge.	No. of cars.
June 30, 1911..	£17,173	5½ %	21·28	7,074,121	£36,002	1·22d.	885,322	60
Dec. 31, 1911..	19,773	6¼ %	23·32	7,757,442	39,476	1·22d.	940,607	64
June 30, 1912..	15,627	5½ %	23·32	7,062,726	36,570	1·24d.	893,927	64
Dec. 31, 1912..	19,720	6 %	23·32	8,202,018	41,367	1·21d.	955,164	64

Edinburgh and District Tramways Co., Ltd.

FROM the annual report it appears that the profit for 1912 is £33,933, as against £35,771 in 1911. The total receipts were £297,468, compared with £292,477 in 1911. The expenditure was £263,535, as against £256,706 a year ago. The traffic receipts per mile run were 10·61d., as against 10·49d. in 1911 ; other receipts per mile run amounted to 0·08d., the same as the previous year, the total receipts per mile run, therefore, being 10·69d., as against 10·57d. in 1911. The expense per mile in respect of working expenses and general charges was 5·45d., as against 5·27d. in 1911 ; while in respect of Corporation charges for rent, it was 4·02d., as against 4·01d., a total expenditure per mile run of 9·47d., as compared with 9·28d. in 1911. The profit per mile run was 1·22d., as compared with 1·29d. in 1911. The mileage open was the same as in the previous year (25¾), and the miles run were 6,676,755, an increase of 35,870. The total passengers carried (including estimate for season tickets) were 64,034,090, an increase of 1,466,502 over 1911. The sum at the credit of the preference shareholders is £5,112, which the directors recommend should be dealt with as follows :—(1) In payment of ordinary dividend for the half-year to December 31st, 1912, at the rate of 5½ per cent. per annum, £2,062 ; (2) in payment of additional dividend of 4 per cent., £3,000 ; (3) in carrying forward to the credit of the preference shareholders £49. The sum at the credit of the deferred shareholders is £7,370, and the directors recommend that it should be dealt with as follows :—(1) In payment of a dividend of 8s. per share for the year to December 31st, 1912, £7,000 ; (2) and in carrying forward to the credit of the deferred shareholders £370. The motive power expenses (cable) totalled £19,356, and the cost of maintenance of cars, lines, cables, machinery, &c., was £40,156. Corporation charges, in respect of the rent of the tramways, amounted to £104,505. Passengers' fares represented a sum of £291,397.

Metropolitan Railway Co.—The directors have declared a dividend on the ordinary stock for the past half-year at the rate of 1¾ per cent. per annum, placing £7,500 to renewals and depreciation fund and carrying forward £9,500. A year ago the dividend was the same, £5,000 was set aside for renewals, and £9,200 was carried forward. The dividend on the surplus lands stock is at the rate of 2¾ per cent. per annum, the same as a year ago, while £800 is carried forward, against £700.

Electric Construction Co., Ltd.—The directors have declared an interim dividend at the rate of 7 per cent. per annum on the preference shares for the half-year ended November 30th.

London Electric Railway Co.—The directors have declared a dividend at the rate of 1 per cent. per annum for the past half-year on the ordinary stock, placing £7,500 to renewals and carrying forward £3,000, as compared with £2,400 a year ago.

Chatham and District Light Railways Co.

THE directors' report for the half-year ended December 31st, 1912, shows that the revenue was £23,977, and the expenses were £13,276, leaving £10,700, less rent of Rochester Corporation lines £1,872, interest on debentures £1,192, interest account £186 = £3,250, leaving £7,451 plus balance brought forward from June, 1912, £2,141, making a balance of £9,592. Of this amount, £4,500 has been transferred to reserve for depreciation, and the directors recommend a dividend at the rate of 5 per cent. per annum for the half-year on the preference shares, absorbing £2,940, a dividend at the rate of 3 per cent. per annum for the half-year on the ordinary shares requiring £1,590, carrying £562 to revenue new account. The traffic receipts show an increase of £12, and the expenses an increase of £414, as compared with the receipts and expenses for the corresponding half-year of 1911, the increase in expenses being mainly due to the enhanced price of coal. During the half-year £2,100 debentures of the company were purchased and redeemed. The difference between the purchase price and par value has been added to reserve for depreciation. A further amount of £3,500 was invested during the half-year in trustee securities. Two additional cars were purchased and put into service in December.

The meeting will be held at 83, Cannon Street, E.C., on February 4th.

Half-year ended.	Miles open.	Passengers carried.	Traffic receipts.	Average fare.	Car-mileage.	No. of cars.
June, 1911 ..	14·98	4,372,850	£21,101	1·16	551,834	45
Dec., 1911 ..	14·98	4,843,236	23,622	1·17	571,790	45
June, 1912 ..	14·98	4,455,807	21,570	1·16	544,512	45
Dec., 1912 ..	14·98	4,850,273	23,634	1·17	567,202	47

Stock Exchange Notices.—Applications have been made to the Committee to appoint a special settling day in—

Universal Cheap Cables, Ltd.—20,000 shares of £1 each fully paid, Nos. 1 t 20,000.

And to allow the following to be quoted in the Official List :—

Cordoba Light, Power and Traction Co., Ltd.—300,000 6 per cent. preference shares of £1 each (special application).

Rhondda Tramways Co., Ltd.—Further issue of £40,000 5 per cent. first mortgage debentures (registered) of £100 each.

The Committee have ordered the undermentioned securities to be quoted in the Official List :—

Calgary Power Co., Ltd.—Further issue of £31,000 5 per cent. 30-year first mortgage bonds of £100 each (Nos. A3,802 to 4,111).

Pennsylvania Water and Power Co.—Further issue of $200,000 first mortgage sinking fund 5 per cent. gold bonds, 1940, of $1,000 each (Nos. 7,681 to 7,880).

Great Northern and City Railway Co.—The report as published in the financial newspapers, states that the total revenue receipts for the six months to December 31st amounted to £39,039, and the cost of working to £21,144, being at the rate of 54·11 per cent. The net revenue, including the balance of £184 brought from last half-year, amounts to £18,099, which is insufficient to meet the company's fixed charges for the half-year. The sum of £5,086, which has been provided from outside sources, has enabled the company duly to meet these charges. The number of passengers for the six months, including season ticket-holders, was 5,968,363, as against 6,119,506 for the corresponding period last year. The number of local season tickets issued during the half-year was 2,191, as against 2,327 for the half-year to December 31st, 1911. The number of three-route season ticket-holders using the company's line during the half-year was 2,889, as against 3,013 for the corresponding half-year. As already notified, the directors have, subject to the consent of the shareholders and to the necessary Parliamentary sanction being obtained, come to an agreement with the Metropolitan Railway Co. for the taking over by the last-named company, as from June 30th, 1913, of the undertaking of the City Co. The agreement come to has been embodied in a Bill which will be submitted in the ensuing session of Parliament. The necessary meetings of the shareholders of the company will be held after the half-yearly meeting for the purpose of submitting the proposals to the acceptance of the proprietors. The arrangement, which involves the dissolution of the company, is one which the directors recommend to the proprietors for their acceptance.

Fusion of the London United and the Metropolitan Tramway Companies.—The holders of upwards of 75 per cent. of each class of share in the Metropolitan and the London United Tramway Companies having accepted the scheme for the fusion of their interests in the companies named with the new company formed for giving due effect thereto, viz., The London and Suburban Traction Co., Ltd., the latter company, in a recent circular, now intimates that in consequence of this support the fusion scheme has become binding, and it is forwarding transfer forms to shareholders in the companies indicated to enable them to transfer their holdings to the Suburban Co., so that as soon as practicable after the registration of the transfers the shares and/or debenture stock of the Suburban Co., to which the acceptors of the scheme are entitled may be issued to them with scrip certificates to bearer for the fractions, if any.

British Columbia Electric Railway Co., Ltd.—The directors have declared a dividend at the rate of 5 per cent. per annum on the non-cumulative preferred ordinary stock for the half-year to December 31st, together with an additional dividend at the rate of 1 per cent. per annum for the same period.

Brazilian Traction, Light and Power Co., Ltd.—The directors have declared a dividend of 1½ per cent

Machine Tool and Engineering Association, Ltd.

In their second annual report the directors state that since their last report 23 firms have joined, bringing the membership up to over 100. The financial position is satisfactory, the balance in hand, after meeting all current liabilities, amounting to £3,954. It is proposed to invest £3,000 of this at once, the remainder being left either on deposit or current account at the bank. The directors do not recommend the payment of a dividend, as they consider it necessary that the association should have ample funds at command for future requirements. It has been decided to transfer the offices of the association to Queen Anne's Chambers, Broadway, Westminster, S.W.

The Exhibition at Olympia was successful, both from the point of the view of the association as a whole, and, so far as information is available, from that of the individual members who exhibited. The total number of exhibitors was 292, the total attendance of the public about 100,000. The proportion of profit on the Olympia Engineering Exhibition appearing in the account was to December 31st, 1912, £3,998. The association was approached by the Exhibitions' Branch of the Board of Trade with the view of joint action in organising a collective exhibit of machine tools at the Ghent Exhibition, and the suggestion was approved by the association, but when invitations to apply for space were sent out to the members, the response was so inadequate as to make it clear to the directors that a representative display was impossible, and the scheme was, therefore, abandoned.

The annual meeting was to be held yesterday at Caxton Hall, S.W.

East London Railway Co.—In their report for the six months ended October 31st, the directors say that it had been hoped that the electrification work in hand would have been completed in time for the line to be opened for electrical working on March 1st. In view, however, of some delays which have unavoidably occurred in the construction of a sub-station the line will probably not be ready for opening until about a month later.

Japan.—The Yokohama Electric Co., of Yokohama, reports a profit of £39,088 for the last half-year, out of which a dividend at the rate of 11 per cent. per annum is being declared.

STOCKS AND SHARES.

Tuesday Evening.

Stock Exchange markets are confused and obsessed by the complexion of the Near Eastern question. Whereas a couple of months ago delay was supposed to make for peace, at the present time the protracted nature of the negotiations is read rather as a bear factor. It certainly has a very restraining effect upon business, and the inevitable tendency is to let prices sag. Expectation looks for peace to be maintained, but this optimism is of subdued sort, and agreement is unanimous that anything might happen by precipitate action on the part of one of the many parties interested.

The Home Railway dividends which have appeared up to the present are not particularly brilliant performances. So far as the electric lines are concerned, the District declaration was the first. The company announces 2 per cent. on its Second Preference stock, and carries forward £8,500, the former being at the same rate as a year ago, and the latter being increased by £6,500. On the figures being published, however, Districts dropped from 42 to 40¾. The Metropolitan declaration, made to-day (Tuesday), is at the rate of 1¾ per cent., with £9,500 forward, the dividend being the same as that of a year ago. The Surplus Lands stock receives 2¾ per cent. "Mets" fell sharply to 52, but rallied to 53¾, thus showing a net gain of ¼ on the week.

The London Electric Railways announces a dividend at the rate of 1 per cent. per annum, and the City and South London reduces its 1½ per cent. of a year ago, to ½ per cent., with £2,588 carried forward, against £2,814. The price of the stock, however, was not affected by the declaration.

Underground Electric shares have shown remarkable strength, and the Ordinary at the end of last week touched 5⅛ bid, reverting later to £5, which still leaves a rise of 2s. 6d. after their previous advances. The 6 per cent. Income Debenture stock is also better, and so are the 1s. shares, but the company's Income Bonds are ½ down. There are no quotable changes in Central Londons, or in Great Northern and City shares. The latter company has just issued what is likely to be its last report, previous to being taken over by the Metropolitan Railway. London United Tramways retain their prices, and this group as a whole is steady.

The electricity supply market shows firmness in several directions. For example: Bromptons are ½ higher, and so are Edmundsons' Preference and St. James' Ordinary; while rises of 1/16 have been secured by Metropolitan Preference and Edmundsons' Non-Cumulative Preference. On the other side of the sheet, South Londons and County Ordinary are both lower, the latter losing 3/16. Midland Corporation Debenture has been in demand, and the quotation has risen to par. One or two proposals are in the air for the flotation of provincial electric supply companies, and the latest which has come under our notice is a scheme for uniting several well-known towns on the Sussex coast for this purpose.

The mention of new issues is a reminder of the draft prospectus in circulation with particulars of the Hydro-Electric Concessions, Ltd., a small concern with a capital of £21,000, formed to investigate and organise hydroelectric power and public utility enterprises in various parts of the world. The ultimate purpose, of course, is to form large public companies through this parent. No doubt the success of the hydroelectric power companies in some of the Canadian cities is at least partially responsible for this latest project.

Latin-Canadian enterprises are mostly a firm market, the steady progress which the best of them are making, leading to quiet absorption of the various issues. The Kaministiquia Power Company, for instance, has just raised its dividend to 5 per cent. for the new quarter, while issuing an excellent report in respect of the past financial twelvemonth. Shawinigan Water has risen 3½. British Columbia Electric stocks are all strong, with rises in the Deferred and Preferred stocks. Rio bonds are ½ better, and so are Sao Paulo bonds. Brazilian Traction shares rose to 102 on strong buying orders from a Brussels group. Southern Electric Trams of Buenos Ayres Debenture put on 2 points, and several prices which were quoted *ex* dividend last Thursday have started to recover part of the distributions. Affairs in Mexico, according to the latest intelligence, are still in a very unsettled condition, though this does not appear greatly to trouble proprietors of the utilities companies' shares and bonds. Other foreign tramway and power descriptions are firm, with the exception of Northern Light and Power bonds, the price of which has been marked down from 27½ to 15. A seller apparently forced stock on to an unwilling market, and purchases were made at 10. As a simple gamble, the bonds might be worth buying about 11 for an upward reaction. Kalgoorlie Preferences are 1/16 lower at 11s. 3d. Madras Electric Debenture rose 1 to 102.

Excitement has quieted down to a large extent in the market for National Telephone stock, but the price shows a still further depreciation, and stock changed hands several times below par early this week. Estimates of the price at which the stock will be repaid are extremely wide, ranging from about 150, predicted by the *Daily Telegraph*, to 93, which the *Economist* conservatively calculates—the other prophets making various estimates between these figures. The award is condemned indignantly and unsparingly by many disappointed holders, who stigmatise it as sheer robbery and spoliation; but it has a few defenders, and these contend that though the taxpayer may have got a good bargain, it is by no means the absurd one which National Telephone Deferred proprietors in some cases maintain. The *Daily Telegraph*, by the way, informed us on Tuesday that Consols had declined on the previous day to 74 1/16 "per oz," so maybe its Telephone calculation is worked out by some table other than sterling.

The Marconi market has recovered some of its mercurial properties, the price moving very fast between 3⅞ and 4 1/16. On publication of the letter addressed by the company to the House of Commons' Committee, asking for the contract with the Government to be nullified, the Stock Exchange market was completely puzzled, and, for the moment, the price of the shares dropped. Discussion and debate on the company's object in doing this led to the view that it was a bold policy which might have a very useful effect. The fear that another Committee might be appointed to deal with the agreement alone had led to the idea that it might be many months before any definite agreement was reached, and what the Stock Exchange hates above anything else is suspense. The company's request for the agreement to be voided was, therefore, hailed as likely to whip up matters rapidly; and the bears saw in it sufficient justification for climbing in, because if the agreement is ratified, it is fairly safe to assume that Marconis will not stop at 3⅞ for long. The Preference shares and the shares of the subsidiary undertakings rallied in sympathy, the whole market taking on a better appearance.

Other Telegraph stocks are quietly firm. There was a slump in American Telephone and Telegraph Capital stock on free offering from New York, and at 137 the price shows a drop of 6. The President-elect's recent fulminations against trusts has caused considerable uneasiness in Wall Street, and fairly substantial falls in American Rails were followed as a natural sequence by declines in other American issues of a trust character. West India and Panamas are more in favour, the price gaining ½; and with the approach of the time for the opening of the Panama Canal, it is expected that these shares will appreciate still further. They are, of course, a very speculative holding. Great Northern Telegraphs rose 10s.; Eastern Extensions are ½ higher, allowing for the dividend; and Eastern Telegraph stock, also *ex*-dividend, is about ¾ up on balance. Direct United States Cable shares recovered their dividend deduction of 2s. 6d.

The Manufacturing division is inanimate. There has been a good rise in British Insulated and Helsby Cable shares, the Ordinary advancing to 8½, while Callenders are again ½ higher at 11½. One or two buying orders for British Westinghouse Preference had the effect of causing the price to harden to 12s. 6d. middle. Armament shares are better on the whole. In the Rubber market a trifling decline in the price of the raw stuff led to the leading speculative shares being put down a little, though for the purely investmen descriptions the public demand has not slackened.

American Telephone and Telegraph Co.—According to the *Financier*, a special meeting of the stockholders will be held on the 30th inst., in New York, to consider and act upon the question of authorising the issue of convertible bonds.

SHARE LIST OF ELECTRICAL COMPANIES.

ENGLISH ELECTRICITY SUPPLY AND POWER COMPANIES.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Jan. 21st.	Rise + or Fall —	Present Yield p.c. £ s. d.
Bournemouth & Poole, Ord.	* 10	5½	5†	9¼ — 10¼	..	5 4 9
Do. 4½ % Pref.	10	4½	4½	8⅞ — 9⅜	..	4 19 4
Do. Second 6 % Pref.	10	6	6	10⅜ — 10¾	..	5 14 8
Do. 4½ % Deb. Stock	Stock	4½	4½	96 — 98	..	4 11 10
Brompton & Kensington, Ord.	5	10	9†	8⅞ — 9⅛	+ ⅛	5 6 8
Do. 7 % Cum. Pref.	5	7	7	8¾ — 9	..	3 17 9
Central Electric Supply, 4 % Guar. Deb.	100	4	4	95 — 98	..	4 1 8
Charing Cross, West End & City	5	5	5†	4⅜ — 5⅛	..	4 17 7
Do. 4½ % Cum. Pref.	5	4½	4½	4½ — 4⅞	— 1/16	4 12 4
Do. "City Undertaking" 4½ % Cum. Pref.	5	4½	4½	3⅞ — 4⅛	..	5 2 10
Do. Do. 4 % Deb.	100	4	4	92 — 94	..	4 5 1
Chelsea, Ord.	5	5	4†	4⅜ — 5⅛	..	4 17 7
Do. 4½ % Deb.	Stock	4½	4½	96 — 99	..	4 10 11
City of London, Ord.	10	8	6†	16 — 18	..	4 9 0
Do. 6 % Cum. Pref.	10	6	6	12 — 13½	..	4 9 0
Do. 5 % Deb.	Stock	5	5	116 —120	..	4 3 4
Do. 4½ % Second Deb.	100	4½	4½	100 —102	..	4 8 3
County of London, Ord.	10	6	4†	11⅜ — 11⅝	— 1/16	5 1 1
Do. 6 % Pref.	10	6	6	11½ — 12	..	5 0 0
Do. 4½ % Deb.	Stock	4½	4½	104 —106	..	4 4 11
Do. 4½ % Second Deb.	Stock	4½	4½	98 —101	..	4 8 8
Edmundson's, Ord.	£3	Nil	..	5/16 — 7/16	..	Nil
Do. 6 % Cum. Pref.	5	Nil	8	4⅛ — 4⅜	..	..
Do. 6% Non-Cum. Pref.	5	..	..	1¼ — 1⅜	+ 1/16	..
Do. 4½ % First Mort. Deb.	100	4½	4½	82 — 85 xd	..	5 5 11
Folkestone	5	6	6	4⅜ — 5¼	..	5 17 1
Do. 5 % Cum. Pref.	5	5	5	4⅜ — 5¼	..	4 17 7
Do. 4½ % First Deb.	100	4½	4½	90 — 92 xd	..	4 17 10
Hove	5	9	8†	7½ — 8	..	5 12 6
Kensington & Knightsbridge, Ord	* 5	1911. 9	1912. 8†	7⅞ — 8⅛	..	£ s. d. 5 10
Do. 4 % Deb.	Stock	4	4	92 — 95	..	4 4 8
Kent Elec. Power, 4½ % Deb.	Stock	4½	4½	76 — 80 xd	..	5 12 6
London Electric, Ord.	3	2½	..	1¼ — 2	..	3 15 0
Do. 6 % Pref.	5	6	6	4⅞ — 5¼	+ 1/16	5 14 3
Do. 4 % First Mort. Deb.	Stock	4	4	89 — 92	+1	4 7 0
Metropolitan	5	4	4†	3⅜ — 3⅞	..	5 3 3
Do. 4½ % Cum. Pref.	5	4½	4½	4⅛ — 4½	+ 1/16	5 0 0
Do. 4½ % First Mort. Deb.	Stock	4½	4½	57 —100	..	4 10 0
Do. 3½ % Mort. Deb.	Stock	3½	3½	84 — 86	..	4 1 5
Midland Electric Corporation 4½ % First Mort. Deb.	100	4½	4½	98 — 101	+1/8	4 9 1
Newcastle-on-Tyne 5 % Pref., Non-Cum.	5	5	5	4⅜ — 4⅞	..	5 2 7
North Metropolitan Power Supply, 5 % Mortgages (Red.)	100	5	5	99½ —102½	..	4 17 7
Notting Hill, 6 % Non-Cum. Pref.	10	6	6	9⅜ — 10⅜	..	5 11 7
Oxford	5	7½	6†	6⅛ — 6⅝	..	5 9 6
St. James' and Pall Mall, Ord.	5	10	10†	9⅝ — 10⅛	..	4 18 9
Do. 7 % Pref.	5	7	7	6¾ — 7¼	..	4 16 7
Do. 3½ % Deb.	100	3½	3½	84 — 87	..	4 0 6
Smithfield Markets, Ord.	5	2	..	1⅜ — 1⅞	..	..
South London, Ord.	4	5	..	2⅜ — 3¼	— ⅛	6 3 1
Do. 5 % First Mort. Deb.	100	5	5	97 —100	..	5 0 0
South Metropolitan, 7 % Pref.	1	7	7	1⅝ — 1¾	..	5 9 5
Do. 4½ % First Deb. Stock	100	4½	4½	96 — 99	..	4 11 3
Urban, Ord.	£3	Nil	..	1/16 — 3/16	..	..
Do. 5 % Cum. Pref.	5	2	..	2⅛ — 3⅛	..	..
Do. 4½ % First Mort. Deb.	100	4½	4½	85 — 88	..	5 2 3
Westminster, Ord.	5	10	9†	8⅞ — 9⅜	..	5 6 8
Do. 4½ % Cum. Pref.	5	4½	4½	4⅜ — 5⅛	..	4 5 9

COLONIAL AND FOREIGN ELECTRICITY SUPPLY AND POWER.

Adelaide, 6 % Pref.	5	6	6	5⅛ — 5⅜	..	5 6 8
Calcutta, Ord.	5	8½	7†	6⅜ — 7⅛	..	5 19 4
Do. 5 % Pref.	5	5	5	4 13/16 — 5 1/16	..	4 16 5
Calgary Power, 1st Mort. Bds.	100	5	5	92 — 94	..	5 6 5
Canadian Gen. El. Com.	$100	7	7	116 —120	..	5 16 8
Do. 7 % Pref.	$100	7	7	120 —124	..	5 18 0
Cordoba Lt., Power and T., Ord.	1	8	5	1⅜ — 1⅝	..	5 6 8
Do. 5 % Deb.	100	5	5	98 — 99	..	5 1 0
Elec. Lt. and P. of Cochabamba, 6 % Bonds	100	6	6	93 — 95	..	6 6 4
Elec. Supply Victoria, 5 % 1st Mort. Deb.	100	5	5	90 — 93	..	5 7 6
Elec. Dev. Ontario, 5 % 1st Mort. Bonds	$500	5	5	95½ — 97½	..	5 2 7
Kalgoorlie Elec. P. and L., Ord.	10/-	Nil	..	3/16 — 5/16	..	Nil
Do. 6 % Pref.	1	6	6	⅜ — ½	— 1/16	9 15 2
Kaministiquia Power, 5 % G. Bs.	$500	5	5	102 —104	..	4 16 2
Madras, Ord.	5	Nil	..	1⅜ — 1⅞	..	..
Melbourne, 5 % 1st Mort. Deb.	100	5	5	101 —104	..	4 16 2
Mexican El. Lt., 5 % 1st M. Bds.	..	5	5	85 — 87	..	5 15 0
Mexican Lt. & Power, Common	$100	4	4†	82 — 86 xd	— ½	4 13 0
Do. 7 % Cum. Pref.	$100	7	7	106 —110	..	6 7 8
Do. 5 % 1st Mort. Gold Bds.	..	5	5	96½ — 98½	..	5 1 6
Monterey Rly. Light & Power, 5 % 1st Mort. Deb.	100	5	5	88 — 90 xd	..	5 11
Montreal, Lt., H. and Power	$100	8	9†	237 —242	..	3 14 5
Northern, Lt., Power and Coal, 5 % 1st Mort. Bonds	$500	5	5a	10 — 20	..	..
River Plate, Ord.	Stock	10	..	217 —227	..	4 8
Do. 6 % Non-Cum. Pref.	Do.	6	6	106 —111	..	5 5 8
Do. 5 % Deb. Stock	Do.	5	5	100 —102	..	4 18 0
Roy. Elec. Co., Montreal, 4½ % 1st Mort. Deb.	100	4½	4½	98 —100	..	4 10 0
Shawinigan Water, Capital	$100	5	5	150 —154 xd	+3½	3 4 11
Do. 5 % Con. 1st Mort. Bonds	$500	5	5	105½ —107½	..	4 13 0
Do. 4½ % Per. Deb.	Stock	4½	4½	100½ —102½	..	4 7 10
Toronto Power, 4½ % Deb.	Do.	4½	4½	98½ —100½	..	4 9 7
Vera Cruz Lt., P. and T., 5 % 1st Mort. Deb.	100	5	5	91 — 94	..	5 6 5
Victoria Falls Power, Pref.	1	11 7/16d.	17 7/16d.	1⅜ — 1	..	..
West Kootenay Power and Lt., 1st Mort. 6 % Gold	100	6	6	103½ —105½	..	5 13 9

TELEGRAPH AND TELEPHONE COMPANIES.

Amazon Telegraph	10	4	4‡†	7 — 7⅛	..	6 0 0
Do. 5 % Deb. Red.	Stock	5	5	97 — 99	+1	5 1 0
American Telep. & Teleg., Cap.	$100	8	8†	136 —138	—5	5 15 11
Do. Collat. Trust	$1000	4	4	91 — 93	— ½	4 6 0
Anglo-American Telegraph	Stock	8	8	65½ — 67½ xd	..	4 8 11
Do. 6 % Pref.	Do.	6	6	110¼ —111½ xd	..	5 7 7
Do. Def.	Do.	80/-	..	24½ — 25 xd	..	6 0 0
Anglo-Portuguese Tel., 5 % Mort. Deb.	100	5	5	102 —104	..	4 16 2
Chili Telephone	5	7	8	7⅛ — 7⅜	..	5 3 3
Commercial Cable, Stlg. 4 % Deb.	Stock	4	4	80 — 82	..	4 17 7
Cuba Telegraph	10	6	6†	8 — 9	..	6 13 4
Do. 10 % Pref.	10	10	10	16 — 17	..	5 17 8
Direct Spanish Telegraph, Ord.	5	4	4†	3¼ — 3½	..	5 6 8
Do. 10 % Cum. Pref.	5	10	10	6⅞ — 7	..	7 2 10
Direct United States Cable	10	5	4	6⅛ — 7⅛ xd	+ ⅛	6 15 7
Direct W. India Cable, 4½ % Reg. Deb.	100	4½	4½	99 —101	..	4 9 0
Eastern Telegraph, Ord. Stock	Stock	7	7†	133 —136 xd	+ ¾	5 2 11
Do. 5½ % Pref. Stock	Do.	5½	5½	78 — 80 xd	..	4 7 6
Do. 4 % Mort. Deb.	Do.	4	4	96 — 98	..	4 1 8
Eastern Extension	10	7	7†	13 — 13⅛ xd	+ ⅛	5 3 8
Do. 4 % Deb.	Stock	4	4	96 — 98	..	4 1 8
East and S. Africa Tel. 4 % Mt. Db. Mauritius Sub.	95	4	4	98 —101	..	3 19 8
Globe Telegraph and Trust	10	6	6†	10⅜ — 10⅞	..	5 10 4
Do. 5 % Pref.	10	5	5	12⅛ — 12⅝	..	4 18 2
Great Northern Telegraph	10	18	18	28½ — 30½	+ ½	5 18 0
Indo-European Telegraph	25	18	6†	56½ — 58½	..	6 11 1
Mackay Companies Common	$100	5	5	87 — 91	+2	5 9 11
Do. 4 % Cum. Pref.	$100	4	4	68 — 71	— ½	5 12 8
Marconi's Wireless Telegraph	1	20	..	4⅜ — 4⅝	— 1/16	4 12 10
Do. 7 % Cum. Partic. Pref.	1	17	..	5⅛ — 5¼	— ¼	4 10 8
Monte Video Telephone, Ord.	1	6	6†	1⅝ — 1¾	..	5 13 0
Do. 5 % Pref.	1	5	5	2⅜ — 2⅝	..	5 18 6
National Telephone Def.	Stock	6	..	99 — 101	—4	..
New York Telep., 4½ % Gen. Bnds.	100	4½	4½	97⅜ — 98⅜	..	4 11 2
Oriental Telep. and Elec.	1	8	6†	1⅜ — 1⅝	..	4 9 10
Do. 6 % Cum. Pref.	1	6	6	1 3/16 — 1 5/16	..	4 18 6
Do. 4 % Red. Deb.	Stock	4	4	87⅛ — 89½ xd	..	4 8 6
Pacific and European Tel., 4 % Guar. Debs.	Do.	4	4	97½ — 99½	— ½	4 0 5
Reuter's	10	10	10†	11⅛ — 11⅝	+ ⅛	8 12 0
Submarine Cables Trust	Cert.	6	6	127 —130	..	4 12 4
Telephone Co. of Egypt, 4½ % Deb. Red.	Stock	4½	4½	97 — 99	..	4 10 11
United River Plate Telephone	5	8	..	7 1/16 — 7⅛	..	5 4 1
Do. 5 % Cum. Pref.	5	5	5	5 1/16 — 5 1/8	..	4 7 11
West Coast of America	2½	2½	..	1 1/16 — 1 1/8	..	4 0 0
Do. 4 % Debs., 1 to 1,500 guar. by Bras. Sub. Tel.	100	4	4	95 — 98	..	4 1 8
West India and Panama Teleg.	10	2½	1½†	3 7/16 — 3 9/16	+ ⅛	..
Do. 6 % Cum. 1st Pref.	10	6	6	10 — 10½	..	5 14 3
Do. 6 % Cum. 2nd Pref.	10	6	6	9½ — 10	..	6 0 0
Do. 5 % Debs.	100	5	5	101 —103	..	4 17 1
Western Telegraph, Ltd.	10	7	7†	13¼ — 13⅝	..	5 2 9
Do. 4 % Deb.	Stock	4	4	94 — 96	..	4 3 4
Western Union 4½ % Fdg. Bonds	$1000	4½	4½	97½ — 100½	..	4 10 0

* Unless otherwise stated, all shares are fully paid. a Paid in deferred interest warrants. † Interim Dividend. ‡ 8s. in Funded Dividend Certs

CONTINUED ON NEXT PAGE.

SHARE LIST OF ELECTRICAL COMPANIES.—(*Continued.*)

ELECTRIC RAILWAYS AND TRAMWAYS.—HOME.

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Jan. 21st.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Bath Trams, Pref. Ord.	1	Nil	Nil	⅜ — ½	..	Nil
Do. 5 % Pref.	1	5	5	1⅛ — 1¼	..	6 8 1
Do. 4½ % Deb.	100	4½	4½	76 — 81	..	5 11 1
Brit. Elec. Trac., 6 % Pref. ..	100	..	..	11 — 13	— ½	..
Do. Do. Deferred ..	100	..	..	5 — 7	..	..
Do. Do. 6 % Cum. Pr'f.	100	6	6	87 — 90	..	6 13 4
Do. 7 % Non-Cum. Pr'f.	100	..	..	38 — 41	—1	..
Do. 5 % Perp. Deb. ..	100	5	5	92 — 96	..	5 4 2
Do. 4½ % 2nd Deb. ..	100	4½	4½	77 — 81	..	5 7 2
Central London Railway, Ord.	100	3	3†	82 — 84	..	3 11 5
Do. Pref.	100	4	4	83 — 85	..	4 14 2
Do. Def.	100	2	..	82 — 84	—1	2 7 7
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
City & South London, Ord. ..	100	1⅛	1½†	37½ — 38½	+1	3 11 5
Do. 5 % Pref., 1891	100	5	5	109 —111	..	4 10 1
Do. Do. 1896	100	5	5	109 —111	..	4 10 1
Do. Do. 1901	100	5	5	109 —111	..	4 10 1
Do. Do. 1908	100	5	5	109 —111	..	4 10 1
Do. 4 % Deb.	100	4	4	98 —100	..	4 0 0
Dublin United Trams, 6 % Pref.	10	6	6	12 — 13	..	4 12 4
Great Northern & City, Pr'f. Ord	10	Nil	Nil	2¼ — 2⅝	..	Nil
Hastings Trams, 6 % Pref. ..	1	6	6†	7⅛ — 7⅝	..	8 6 8
Do. 4½ % Deb.	100	4½	4½	69 — 74	..	6 1 7
Isle of Thanet Trams, 5 % Pref.	5	2½	2½	2⅛ — 2⅜	..	4 15 3
Do. 4 % Deb.	100	4	4	75 — 80	..	5 0 0
Lancashire United, 5 % Deb. ..	100	5	5	78 — 80	..	6 5 0
London Elec. Railw'ys, 4 % Deb.	100	4	4	95 — 97	..	4 2 6
London United Trams, 5 % Pref.	10	Nil	..	5 — 6	..	..
Do. 4 % Deb.	100	4	4	69 — 72	..	5 11 1

NAME.	Stock or Share.	Dividends for 1911.	Dividends for 1912.	Closing Quotations Jan. 21st.	Rise + or Fall —	Present Yield p.c.
	*					£ s. d.
Metropolitan Railway Consol. ..	100	1⅞	1¾†	53½ — 54	+ ¼	3 0 2
Do. Surplus Lands	100	2⅛	2⅛	61 — 63	..	4 6 0
Do. 3½ % Deb.	100	3½	3½	86 — 88 xd	..	3 17 9
Do. 3½ % Pref.	100	3½	3½	85 — 87	..	4 0 6
Do. 3½ % Con. Pref.	100	3½	3½	84 — 86	..	4 1 5
Metropolitan District Ord. ..	100	Nil	Nil	40½ — 41	—1¼	Nil
Do. 6 % Deb.	100	6	6	139 —141	..	4 4 0
Do. 4 % Deb.	100	4	4	93 — 95	..	4 2 6
Do. 4 % Prior Lien	100	4	4	99 —101	..	3 19 8
Do. 4½ % First Pref.	100	4½	4½	89 — 91	..	4 18 11
Do. 3½ % Gtd.	100	3½	3½	76 — 78	..	4 9 9
Metropolitan Elec. Trams, Ord.	1	6	5†	1 1/16 — 1 3/16	..	5 1 1
Do. Def.	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % Pref.	1	5	5	3/8 — 5/8	..	5 14 8
Do. 4½ % Deb.	100	4½	4½	89 — 92	..	4 17 10
Do. 5 % Deb.	100	5	5	94 — 97	..	5 3 1
Potteries, Ord.	1	8½	..	5/16 — 7/16	..	..
Do. 5 % Pref.	1	5	5	11/16 — 13/16	..	6 19 0
Do. 4½ % Deb.	100	4½	4½	85 — 88	..	5 2 2
South Metro. Trams, 6 % Pref.	1	6	..	11/16 — 13/16	..	7 7 8
Do. 4 % Deb.	100	4	4	65 — 70	..	5 14 4
Underground Elec. Railways	10	..	..	4⅞ — 5⅛	+ ⅛	Nil
Do. "A"	1/-	..	..	3/32 — 1/8	+ 1/32	..
Do. 6% First Cum. Inc. Deb.	100	..	6	111½ —113½	+ ½	5 5 9
Do. 4½ % Bonds	100	4½	4½	98 —100	..	4 10 0
Do. 6 % Income	100	1½	£2	94½ — 95½	— ½	..
Yorkshire (West Riding), Ord.	5	Nil	..	1/8 — 3/8	..	Nil
Do. 6 % Pref.	5	3	3½	2⅜ — 2¾	..	4 12 4
Do. 4½ % Deb.	100	4½	4½	77 — 81	..	5 8 5

ELECTRICAL RAILWAYS AND TRAMWAYS.—COLONIAL AND FOREIGN.

Anglo-Arg. Trams, 1st Pref. ..	5	5½	5½	4⅞ — 5⅛	..	5 7 4
Do. 2nd Pref.	5	5½	5½	4⅞ — 4⅞	..	5 14 8
Do. 4 % Deb.	100	4	4	92½ — 94½	..	4 4 8
Do. 4½ % Deb.	100	4½	4½	98 —100	..	4 10 0
Do. 5 % Deb.	100	5	5	98½ —100½	..	4 19 6
Auckland Trams, 5 % Deb. ..	100	5	5	101 —103	..	4 17 1
Bombay Elec. S. & Trams, Pref.	10	6	6	11½ — 12½	..	4 18 0
Do. 4½ % Deb.	100	4½	4½	96 — 98	..	4 11 10
Do. 5 % 2nd Deb.	100	5	5	97 — 99	..	5 1 0
Brazilian Traction Light and Power	$100	..	..	101 —103	+3	..
Brisbane Trams Invt., Ord. ..	5	8	8†	6⅞ — 7⅛	..	5 8 6
Do. 5 % Pref.	5	5	5	4⅞ — 5⅛	..	4 15 3
Do. 4½ % Deb.	100	4½	4½	99 —102	..	4 8 3
B. Columbia Elec. Rly., Def. ..	100	8	..	141 —145	+2	5 10 4
Do. Pref. Ord.	100	6	6	120 —124	+1	4 16 9
Do. 5 % Pref.	100	5	5	105 —108 xd	..	4 12 7
Do. 4½ % 1st Mort. Deb. ..	40	4½	4½	100 —103	..	4 7 5
Do. 4½ % Vancouver Deb. ..	100	4½	4½	101 —103 xd	..	4 7 5
Do. 4½ % Con. Deb.	100	4½	4½	97 —100	..	4 5 0
Calcutta Trams, Ord.	5	7	5†	5⅝ — 6⅛	..	5 12 0
Do. 5 % Pref.	5	5	5	4⅛ — 5⅛	..	4 17 7
Do. 4½ % Deb.	100	4½	4½	97 —100	..	4 10 0
Cape Electric Trams	1	2½	..	3/8 — 5/8	..	..
City Buenos Aires Trams (1904)	5	5	5†	5⅞ — 5⅞	..	4 8 0
Do. 4 % Deb.	100	5	5	97 —100	..	5 0 0
Colombo Elec. Tr. & Lt., 5 % Deb.	100	5	5	98 — 97	..	5 2 1
Havana Elec. Rly., 5 % Bonds	$1000	5	5	98 —102 xd	..	4 18 0
Kalgoorlie Elec. Trams	1	Nil	..	1/16 — 3/16	..	Nil
Do. 5 % A Deb.	100	5	5	88 — 88	..	5 13 8
Do. 6 % B Deb.	100	6	3	30 — 40	..	..

La Plata Elec. Trms, Ord. ..	1	Nil	..	1/16 — 3/16	..	..
Do. Pref.	1	6	..	7/8 — 1	..	6 0 6
Lisbon Elec. Trams, Ord. ..	1	6	6†	1 — 1¼	..	4 16 0
Do. 6 % Pref.	1	6	6	1 — 1¼	..	4 16 0
Do. 5 % Deb.	100	5	5	91 — 96	..	5 5 3
Madras Elec. Tr. (1904), Deb. ..	100	5	5	101 —103	+1	4 17 1
Manaos Trams & Lt., 1st Deb. ..	100	5	5	87 — 90	..	5 11 1
Manila Elec. R. and Ltg., Bonds	$1000	5	5	100½—102½	..	4 17 7
Mexico Trams Com.	$100	7	7†	110 —112 xd	..	6 5 0
Do. Gen. Con. 5 % Bonds ..	..	5	5	98 —100	..	5 0 0
Do. 6 % Bonds	100	6	6	101 —103	..	5 16 6
Para Elec. Rlys. & Lt., Ord. ..	5	10	10†	7⅛ — 8	..	6 5 0
Do. 6 % Pref.	5	6	6	4⅞ — 5⅛	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	98 —100	..	5 0 0
Perth (W.A.) Elec. Tr., Ord. ..	1	5	5⅛	1⅜ — 1½	..	3 14 5
Do. 5 % 1st. Deb.	100	5	5	105 —108	..	4 12 7
Rangoon El. Tr. & Sup., Pref. ..	5	6	6	5⅜ — 5⅞	..	5 0 0
Do. 4½ % 1st Deb.	100	4½	4½	97 — 99	..	4 10 11
Rio de Janeiro Trams, 1st Mort. 5 % Bonds	..	5	5	101 —103	+ ½	4 17 1
Do. 5 % Mort. Bonds ..	100	5	5	96½ — 98½	..	5 1 6
Sao Paulo Tram, Lt. and P. 5 % 1st Deb.	$500	5	5	103½—105½	+ ½	4 14 9
Singapore Trams, 5 % Deb. ..	100	5	5	82 — 85	..	5 17 8
Southern El. Tr. B.A., 5 % Deb.	100	5	5	99 —101	+2	4 19 0
Un. Elec. Trams Monte Video ..	5	7	6†	5⅜ — 5⅞	..	5 19 2
Do. 6 % Pref.	5	6	6	4⅛ — 4⅜	..	5 11 7
Do. 5 % 1st Deb.	100	5	5	99 —102	..	4 18 0
Winnipeg Elec. Rly., 4½ % Deb.	100	4½	4½	99½—102½	..	4 7 10

MANUFACTURING COMPANIES.

Aron, Ord.	1	6	..	1/4 — 3/8	..	8 0 0
Do. 6 % Pref.	1	6	6	1 1/16 — 1 3/16	..	7 7 8
Babcock & Wilcox	1	28	14†	9 3/16 — 9 5/16	..	4 14 0
Do. Pref.	1	6	6	1 1/16 — 1 3/16	..	4 0 0
British Aluminium, Ord. ..	1	Nil	..	1/16 — 3/16	..	..
Do. 6 % Cum. Pref.	1	Nil	..	1 1/16 — 1 3/16	..	..
Do. 5 % Prior Lien Debs. ..	100	5	5	90 — 93	+1	5 7 6
Do. Deb. Stk.	100	5	5	86 — 89	..	5 12 4
B.I. & Helsby Cables	5	10	8†	8 — 8⅛	+ 1/32	5 17 8
Do. Pref.	5	6	6	5⅞ — 6⅛	..	4 14 1
Do. Deb.	100	4½	4½	102 —104	..	4 6 7
British Thomson-Houston, Deb.	100	4½	4½	94 — 96	..	4 13 9
British Westinghouse, Pref. ..	3	Nil	Nil	1/32 — 3/32	+ 1/32	Nil
Do. Deb.	100	4	4	58 — 61	..	6 11 2
Do. 6 % Prior Lien	100	6	6	100 —103	..	5 16 6
Browett, Lindley, Ord.	1	..	..	3/- — 3/-	..	Nil
Do. Pref.	1	..	..	4/6 — 5/-	..	Nil
Brush, 7 % Pref.	2	Nil	Nil	0 — 1/4	..	Nil
Do. 5 % Prior Lien Deb. ..	100	5	5	73 — 78	..	6 8 2
Do. 4½ % Deb.	100	4½	4½	47 — 52	..	8 13 2
Do. 4½ % Second Deb. ..	100	4½	4½	28 — 32	..	14 1 4
Callender's Cable	5	15	10†	10⅜ — 11⅛	+ ⅛	6 16 5
Do. Pref.	5	5	5	4⅛ — 5⅛	..	4 17 7
Do. Deb.	100	4½	4½	97 —100	..	4 10 0
Castner-Kellner	1	20	20	31⅛ — 31⅜	..	5 5 0
Do. Deb.	100	4½	4½	106 —109	..	4 2 7

Crompton & Co.	3	Nil	..	1/16 — 3/16	..	Nil
Do. Deb.	100	5	5	53½ — 55½	..	9 1 10
Dick, Kerr	1	5	Nil	3/16 — 5/16	..	..
Do. Pref.	1	6	6	1/4 — 3/8	..	6 17 2
Do. Deb.	100	4½	4½	95 — 98	..	4 11 10
Edison & Swan, A, £3 paid ..	5	Nil	..	1/16 — 3/16	..	Nil
Do. fully paid	5	Nil	..	1 — 1⅛	..	Nil
Do. 4 % Deb.	100	4	4	64 — 68	..	5 17 8
Do. 5 % Second Deb.	100	5	5	72 — 75	..	6 13 4
Electric Construction	2	2½	3½	1 1/16 — 1 1/8	..	7 1 4
Do. Pref.	2	7	7	1 15/16 — 2	..	7 0 0
Greenwood & Batley, Pref. ..	10	7	7	7½ — 8	..	8 5 8
Do. Deb.	100	5	5	92 — 94	..	5 4 2
General Electric, Pref.	10	5	5	9⅜ — 10⅜	..	..
Do. Deb.	100	4	4	90 — 95	..	4 4 3
Henley's, Ord.	5	17	5†	12⅜ — 13½	..	6 6 0
Do. Pref.	5	4½	4½	4⅞ — 5⅛	..	4 7 10
Do. Deb.	100	4½	4½	101 —103	..	4 7 5
India-Rubber, G. & T.	10	..	7½	10 — 11	..	6 16 4
Do. Pref.	10	5	5	9⅞ — 10½	..	4 17 7
Telegraph Construction	12	17½	5†	84½ — 86½	..	5 13 0
Do. Deb.	100	4	4	95½ — 98½	..	4 1 3
Willans & Robinson	1	Nil	..	1/16 — 3/16	..	Nil
Do. Pref.	5	Nil	..	1/2 — 3/4	..	Nil
Do. Deb.	100	4	4	57 — 59	..	6 15 7

* Unless otherwise stated, all shares are fully paid. † Interim dividend.

CONTROL OF THREE-PHASE VARIABLE SPEED A.C. MOTORS.

THREE-PHASE alternate-current motors are now used in many industrial applications in which some degree of speed regulation is desirable. Such regulation is specially necessary for economy in the case of motors driving pit fans. At the time of opening the pit, the volume of air required for ventilation may be only 40-70 per cent. of the volume ultimately needed. Assuming that the initial requirements are as high as 70 per cent. of the final maximum value, the power required during the earlier stages is only 35-40 per cent. of that required for maximum delivery. It is obviously important that the speed reduction be obtained as efficiently as possible. According to the special conditions of the case, the fan may run at reduced output for one, two, three or more years, hence any system which improves the running efficiency at reduced speed easily recovers the heaviest additional capital outlay which is likely to be involved.

The most obvious method (to the electrical engineer) of controlling the speed of a three-phase slip-ring motor, is to insert more or less external resistance in the rotor circuit. To the mechanical engineer, the most obvious means of controlling the fan delivery is to throttle the inlet passage. Both of these methods are inefficient and involve large dead losses, but of the two the former is far preferable.

In the ELECTRICAL REVIEW, August 23rd, 1912, pp. 285-286, particulars were given of the efficiency of the simple cascade system in connection with pit fan motor control, and it was shown that this system offers considerable advantages as regards efficiency and power factor. The data given below compare throttle and simple resistance control with the Scherbius system in operating a 650-H.P., 2,000-volt, 50 cycles, three-phase motor driving a Rateau fan of present and ultimate capacity, 5,600 and 8,000 cb. m. per min. respectively. The general principle of the Scherbius system is well known. In the present case, the main three-phase slip-ring motor is provided with speed regulation between 150 and 220 R.P.M., and drives the ventilating fan at corresponding speeds ranging from 325 to 475 R.P.M. Speed control is obtained by varying the excitation of an alternating-current commutator motor connected to the main motor rotor, thus applying variable back E.M.F. to the latter. When the speed of the main motor is less than normal (here 485 R.P.M.) slip energy is transferred to the commutator motor which drives an induction generator feeding energy back to the supply mains. The necessary hand and automatic switchgear is provided for starting and controlling purposes; this need not be considered in the present connection, but a full description is to be found in "Gluckauf," 48 pp. 1,668 *et seq.*

A centrifugal governor is mounted on the converter shaft and coupled to an isolating switch, so that energy supply is interrupted in the event of the converter racing, owing to any fault which prevents return of energy to the bus-bars. Special switchgear is provided to enable the stator coils of the main motor to be placed in "star" for low speeds and in "delta" for high speeds; as shown by fig. 2, this conversion considerably improves the overall efficiency at low speeds and improves the commutation of the converter motor by keeping the applied voltage at a low value.

By the use of a phase transformer and switchgear, the power factor of the main motor can be brought to unity or a leading current can be taken if desired (though efficiency is then somewhat sacrificed owing to the higher copper loss). For convenience and efficiency, it is desirable to place the whole equipment within as small a space as possible, but, if so desired, the main and auxiliary parts can be located in separate rooms.

The light losses in the present equipment at various speeds are shown in fig. 1, and the overall efficiency on load (at various speeds and hence volume outputs), is shown by Curve A, fig. 2. This curve clearly shows the gain in efficiency by star connection when running at low speeds (the decreased iron losses then more than compensating for the higher copper loss); at about 390 R.P.M., either connection yields the same efficiency (85·2 per cent.).

The considerable advantage in favour of the Scherbius system, as compared with simple rotor resistance regulation is shown by Curve B, fig. 2.

Fig. 3 compares the above two systems with throttle regulation. The curves for the Scherbius cascade converter system and simple resistance control are transferred from fig. 2 (taking account of the percentage volume output corresponding to various fan speeds). The power curve for the throttle regulation system is determined as follows: The volume of air delivered is, at constant R.P.M., proportional to the equivalent aperture, with which, therefore, varies the driving power so long as the fan efficiency is constant. Fig. 2 shows that the motor H.P. = 650 for a speed of 485 R.P.M., and, corresponding to a speed of 330 R.P.M. = $\frac{330}{485} \times 650$ = 442 H.P. Taking into account the alteration in fan efficiency, the (power-volume) curve falls linearly from 650 to 495 H.P., and, accounting for motor efficiency, the actual (H.P.-volume) curve is as shown in fig. 3.

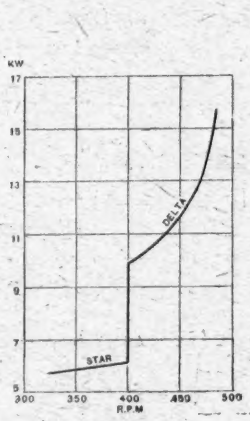


FIG. 1.

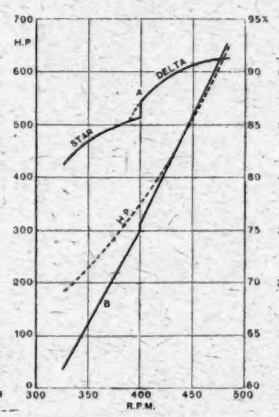


FIG. 2.

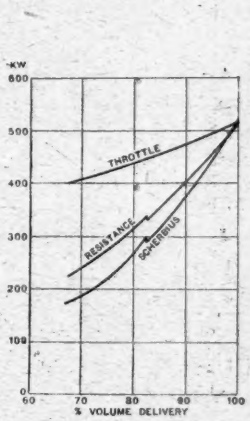


FIG. 3.

Throttle regulation is clearly very inefficient; resistance regulation is much more efficient, and the additional capital outlay required is only the difference in cost between the starter required under the throttle system and the resistance regulator required in the other case.

In this instance, the Scherbius system required a capital outlay nearly £750 higher than would be required by a simple resistance regulator. At first sight, this appears to be a serious matter, but if the fan runs continuously for 18 months at 70 per cent. of its rated volume output, the power saved is 53 KW., and, with electrical energy at 0·3d. per unit, the reduction in the total energy bill more than recoups the additional capital outlay in question.

A Novel Electro-medical Outfit.—According to a recent issue of the *Autocar*, Dr. Gamlen, of West Hartlepool, has had his car fitted to his own plans with an electric equipment whereby electrical current can be generated for a portable X-ray equipment. When it is desired to set up the equipment, the near side back wheel is jacked up and removed, and a spare wheel, which is carried minus its tire, is used as a belt pulley and coupled up to the pulley on a portable dynamo by a short flat belt. The dynamo is supported on a small table carried on the car, the table in question being fixed to the running board so as to maintain the tension of the belt drive. The rear mudguard of the car is made readily detachable, so that it shall not be damaged or get in the way of the belt. In addition to providing current for the X-ray equipment, this arrangement, by the aid of a special switchboard, enables various forms of electrical treatment to be administered, the car meanwhile being, of course, outside the patient's house. Plenty of cable is carried to enable the current to be taken to any convenient point.

GRAPHS IN A CABLE-SHIP DRUM-ROOM: NOTES FOR JUNIOR ASSISTANTS.

BY EDWARD RAYMOND-BARKER.

(*Continued from page* 115.)

32. A more serviceable example of the graph method is shown in fig. 4.

Ordinates.—Cable circumference in inches.

Abscissæ.—Percentage of cable-length increase for any given cable drum (in this case, d_1) due to addition of any cable circumference.

A curve, as shown in fig. 4, may be prepared for any given cable drum.

In fig. 4 *dots* are plottings for 3 in. to 9·5 in. cable circumferences. *Crosses* and *circles* are plottings from tabular records of two cable-laying expeditions.

33. Practical application of fig. 4.—Certain cable, in course of cable-diversion operations, was picked up, amounting to 7,585 revs. of drum d_1. Mean cable circumference

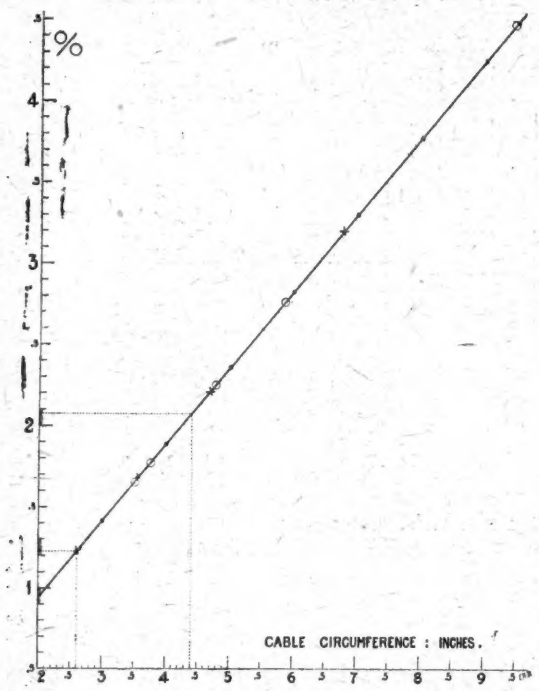


FIG. 4.

was found to be 4·4 in. In fig. 4, co-ordinates in dotted lines show that, in the case of this particular drum (d_1) and cable 4·4 in. circumference, a further 2·075 per cent. must be added to the uncorrected length picked up.

34. By uncorrected drum-constant (d_1)—see fig. 3—cable picked up = 7,585/344·15 = 21·838 N.M.

2·075 per cent. of 21·838 = 0·453 N.M. (By slide rule.)

21·838 + 0·453 = 22·291 N.M., correct length picked up.

35. To check the above figures by the customary method :—(See 23).

$$\text{Corrected drum-constant} = \frac{73{,}044}{212{\cdot}24 + 4{\cdot}40} = 337{\cdot}16;$$

7,585/337·16 = 22·291 N.M., correct length picked up.

Note :—Figs. 3 and 4, as printed, are on a scale about 1/7·5 of the original curve-sheets.

36. A useful table during the laying of a cable is one in terms of *drum-revs. per min.*, and the equivalents in N.M. *per hour* for all cable types on board. In 24 there is an example of 1 corrected drum-rev. of 0·002941 N.M. This refers to cable of 2·60 in. circumference. Let us take a paying-out speed of 40 drum-revs. per min. × 60 min. = 7·06 N.M. per hour.

37. A quick way of compiling a table is to take—say—the above example, as follows :—0·002941 × 60 = 0·17648 as a constant for a given type of cable.

Then 0·17648 × 30 revs. per min. = 5·29 N.M. per hour,

0·17648 × 40 revs. per min. = 7·06 N.M. per hour, and so on.

38. An alternative plan is to apply graphic methods by utilising the curve in fig. 4, which is that for drum d_1, with an *uncorrected* constant of 344·15, as shown in fig. 3.

Then 1/344·15 = 0·0029058 × 60 = 0·17435.

0·17435 × 40 revs. per min. = 6·97 N.M. per hour uncorrected. The circumference of the cable in question is 2·60 in.; therefore, by curve in fig. 4, to 6·97 a further 1·225 per cent.—that is, 0·09 N.M.—has to be added, = 7·06 N.M. per hour, as in 37.

In this way a table may be compiled, in view of subsequent correction from curve in fig. 4, *applicable to all cable types.*

39. The following practical and comprehensive example deals with a length of cable made up of four different types : *Shore End* (AA_2), *Heavy Intermediate* (E), *Light Intermediate* (B), and *Deep Sea* (D_1).

During certain cable-laying operations the exact length paid out from shore up to a given time, say, 8 p.m. was required. The said length included three splices (sp.) uniting four different types of cable.

40. Data :—

Circumference of paying-out drum (see 19)	=	212·24 in.
,, ,, cable type AA_2 (see 27)	=	6·775 ,,
,, ,, ,, ,, E	=	4·680 ,,
,, ,, ,, ,, B	=	3·564 ,,
,, ,, ,, ,, D_1	=	2·600 ,,

41. The several *drum-constants* (see 23) therefore become :—

For type AA_2	=	333·50 revs. per N.M.
,, ,, E	=	336·72 ,, ,, ,,
,, ,, B	=	338·46 ,, ,, ,,
,, ,, D_1	=	339·98 ,, ,, ,,

42. When sp. $\frac{AA_2}{E}$ passed drum, indicator (see 17) showed 2,331 (+ ·5) revs.

2,331·5/333·50 = 6·991 N.M. type AA_2 paid out.

When sp. E/B passed, indicator gave 11,481·5 revs.

11,481·5 − 2,331·5 = 9,150 revs.

9,150/336·72 = 27·175 N.M. type E paid out.

When sp. B/D_1 passed, indicator gave 16,618·5 revs.

16,618·5 − 11,481·5 = 5,137 revs.

5,137/338·46 = 15·178 N.M., type B, paid out.

At 8 p.m., drum-indicator gave 23,993·5 revs.

23,993·5 − 16,618·5 = 7,375 revs.

7,375/339·98 = 21·692 N.M., type D_1, paid out up to 8 p.m.

Total paid out { Type AA_2, 6·991 N.M. ; ,, E, 27·175 ,, ; ,, B, 15·178 ,, ; ,, D_1, 21·692 ,, } = 71·036 N.M.

43. The above is the customary routine. If, to the same example, we apply the *graph* method described in 32 . . 34, figures will be as follows :—

GRAPH METHOD.

Drum-constant as it is *per se*, a real absolute invariable constant, uncorrected for any cable circumference = $\frac{73{,}044 \text{ in.} = 1 \text{ N.M.}}{212{\cdot}24 \text{ in. circe.}}$ = 344·15 revs. per N.M.

Measurements from curve in fig. 4 show that to drum-indicator lengths of cable types :—

AA_2	circe.	6·775 in.,	a correction of	3·19 %	must be added.	
E	,,	4·680 ,,	,,	2·21 %	,,	,,
B	,,	3·564 ,,	,,	1·68 %	,,	,,
D_1	,,	2·600 ,,	,,	1·23 %	,,	,,

Applying *graph* values from fig. 4 to the above example (42) :—

When sp. A A_2/E passed, indicator = 2,331 (+ ·5) revs. 2,331·5/344·15 + 3·19 per cent. = 6·775 + 0·216 = 6·991 N.M. (A A_2).

When sp. E/B passed, indicator = 11,481·5 − 2,331·5 = 9,150 revs. 9,150/344·15 + 2·21 per cent. = 26·587 + 0·588 = 27·175 N.M. (E).

When sp. B/D_1 passed, indicator = 16,618·5 − 11,481·5 = 5,137 revs. 5,137/344·15 + 1·68 per cent. = 14·927 + 0·251 = 15·178 N.M. (B).

At 8 p.m. indicator = 23,993·5 − 16,618·5 = 7,375 revs. 7,375/344·15 + 1·23 per cent. = 21·429 + 0·263 = 21·692 N.M. (D_1).

Total paid out up to 8 p.m. = 71·036 N.M.

N.B.—The foregoing percentage corrections are quickly applied with a slide rule.

laying may conveniently be ascertained by the paying out—simultaneously with the cable—of a fine steel wire absolutely taut, the speed rate of which is accurately given by a measuring wheel and counter. This method was first advocated in 1876 by the late Dr. Werner Siemens, but it did not come into general use until a comparatively recent date. The *taut-wire* device may best be described in the words (abridged) of its originator, from a paper read by him before the Society of Telegraph Engineers.

47. "To obtain precisely any desired slack, the only method will be to pay out, with the cable . . . a wire. . . . If this wire . . . be retained with sufficient brake power to be paid out without slack, and, therefore, with tension on the sea bottom, a counter will give the exact progress of

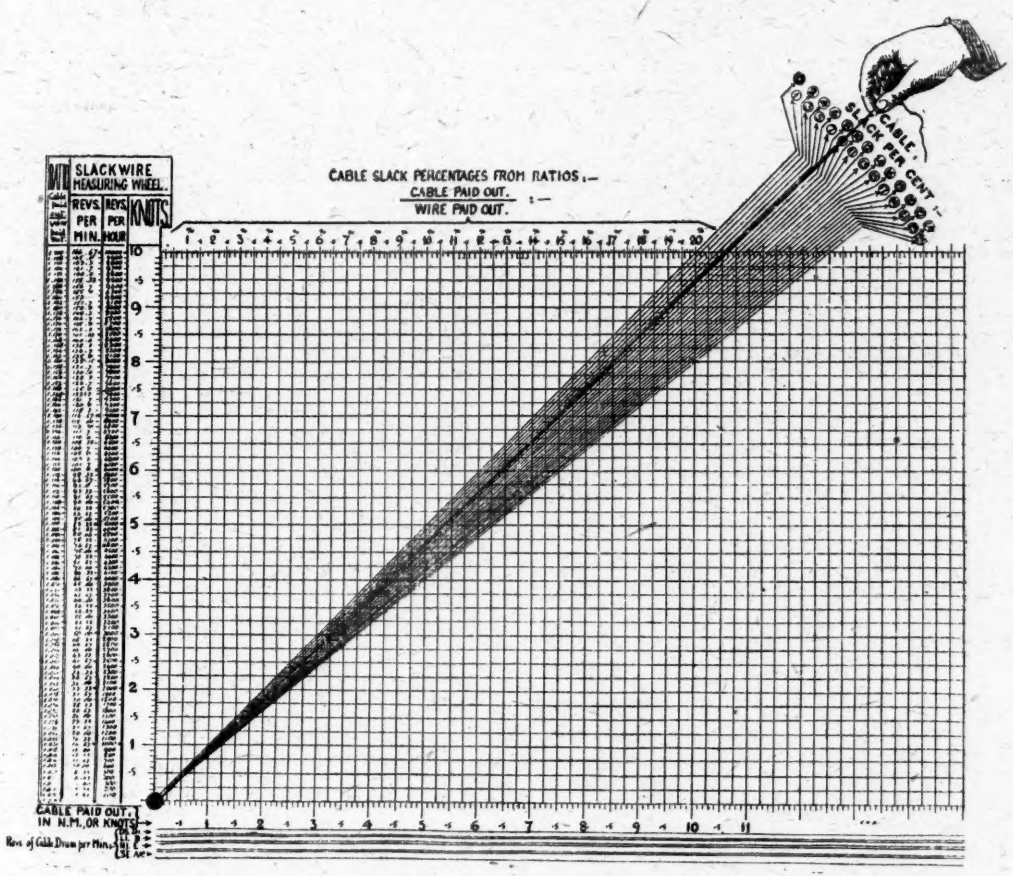


FIG. 5. (Reduced from 2 ft. 5 in. × 1 ft. 11 in.)

CABLE SLACK PER CENT.

44. One of the many important mechanical data in great request during cable-laying operations is that relating to the percentage of slack laid at any given time, or average slack for any given time period.

The amount of slack required varies with attendant conditions, having regard, chiefly, to the nature and configuration of the sea bottom over which the cable ship is passing.

There are various ways of estimating traversed distance (nautical miles) or speed rate (knots) over ground—*i.e.*, an imaginary line representing the track of the ship from point to point.

45. Given the distance over ground, and the amount of cable actually paid out; or, given the speed (S) of the ship through the water, and that (C) at which the cable is actually paid out, a simple comparison affords the necessary data for knowing slack per cent. (P), or $P = 100\ \frac{C - S}{S}$. On the other hand, given the speed (S) of the ship, and the percentage (P) of slack thought desirable, the speed at which the cable must leave the ship may be calculated, or $C = S + PS/100$.

46. The ship's speed through the water during cable-laying may conveniently be ascertained by the paying out—simultaneously with the cable—of a fine steel wire absolutely taut, the speed rate of which is accurately given by a measuring wheel and counter. This method was first advocated in 1876 by the late Dr. Werner Siemens, but it did not come into general use until a comparatively recent date. The *taut-wire* device may best be described in the words (abridged) of its originator, from a paper read by him before the Society of Telegraph Engineers.

47. "To obtain precisely any desired slack, the only method will be to pay out, with the cable . . . a wire. . . . If this wire . . . be retained with sufficient brake power to be paid out without slack, and, therefore, with tension on the sea bottom, a counter will give the exact progress of the vessel, even without the errors caused by currents; therefore the brake has only to be maintained under the pressure that will give any desired ratio between the velocities with which the cable and the wire are run out. . . ."

TAUT-WIRE GEAR IN PRACTICE.

48. In recent practice the taut-wire measuring wheel has been given a *circumference* which, allowing for the circumference (see 20 . . . 22) of the 0·032 in. diameter bright steel wire (S.W.G. No. 21) weight 16·74 lb. per N.M., will cause its every revolution when carrying the wire round the wheel's V-section periphery, to be equivalent to exactly one-thousandth of a nautical mile = 0·001 N.M. = 6·087 ft. = 73·044 in. of wire.

49. An equivalent of a speed-rate of one measuring-wheel rev. per min. of course would be 0·001 N.M. × 60 = 0·060 N.M. per hour. On this basis a convenient table may be compiled to include all values within likely limits. Example :—

100 revs. per min. = 6·00 N.M. per hour.
155 „ „ „ = 9·30 „ „ „

50. Custom varies regarding the appellation of this contrivance which, sometimes, instead of being called the *taut*

wire, receives the name of *slack* wire, from its use in leading to a knowledge of cable *slack* per cent. paid out.

CABLE SLACK PER CENT. GRAPHS.

51. The writer has devised a series of graphs illustrative of the whole question of the ratio between the two velocities, viz., of *taut-wire* and of *cable*.

52. Fig. 5, although unsuitable—as will further be explained—for final adoption in practice, shows the general principle of the cable-slack graph. Under the heading "*slack-wire measuring wheel*," a vertical scale graduated in knots (*i.e.*, N.M. per hour) stands parallel to equivalent slack-wire values in terms of *revs. per hour*, and *revs. per min.*

53. At right angles to the vertical scale lies a horizontal scale graduated in *cable* knots.

54. Parallel with the horizontal cable-distance or cable-speed scale, are spaces in which, on the occasion of each expedition, cable speeds may be pencilled in terms of *paying-out drum revs. per min.* for all the various types of cable on the ship. These pencilled drum-revs. per min. may be erased when done with. Drum-rev. spaces will be shown in more developed form in fig. 7.

55. From the *origin* of the vertical and the horizontal axes, straight-line "curves" are drawn diagonally across the diagram-sheet to figures in terms of cable-slack per cent., *zero* per cent. to 20 per cent.

56. *Taut-wire* and *cable* co-ordinates always intersect on, or close to, the corresponding diagonal line indicating *cable slack* per cent.

57. The diagonal line on which any *taut-wire* and *cable* co-ordinates intersect will, at its upper end, indicate cable *slack per cent.*

58. If the co-ordinates intersect *between* two diagonal lines, the decimal fraction to be added to the lower percentage may easily be appreciated.

59. A black thread—one end pinned at the point of origin, the other held taut in the operator's hand—on being brought to the intersection of *taut-wire* and *cable* co-ordinates, will be found to coincide with the diagonal line indicating cable *slack per cent.*

60. Conversely, if the thread be brought to the intersection of any *taut-wire* co-ordinate with any *slack per cent.* diagonal, that *cable* co-ordinate found to pass through the same intersection will, at its lower end, indicate the *cable speed* necessary to bring about the required *slack per cent.*

Note: Practical examples will be given from later graphs.

61. Fig. 5 includes a supplementary vertical column of ratios *cable/wire* paid out.

A horizontal line, extended from any given ratio, abuts on the *zero* diagonal line at a point from which a vertical line, at its upper end, will indicate cable slack per cent.

62. Fig. 5 sufficiently indicates general principles, but is weak in regard to practical requirements, inasmuch as, where the diagonal straight-line curves approach to and converge at their common *origin*, they merge into a useless blur.

(*To be continued.*)

Credit and Security.—A certain amount of ephemeral interest has been excited by the replies of Mr. J. P. Morgan in his examination before the so-called Money Trust Commission at Washington. Mr. Morgan is reported to have said that credit is based primarily upon character, and not upon money or property, otherwise collateral or collateral security. In another place he is alleged to state substantially his practice thus: "I always know the person to whom I lend, or something of him." "If I see there is a loan to Mr. Smith, and I do not like his character, I say, you call that loan right away" (which is very Yankee). "I would not have that loan in the box." "I would not have that loan."

There is nothing that is original in these statements. Naturally if a person has achieved an unenviable notoriety, in other words, whose character is bad, some people would possibly not entertain his proposals on any security; but premising that person to possess a character above suspicion, it is too much to say that his unimpeachable character alone would gain him his object without the production of substantial and the proper kind of collateral. At any rate, generally speaking, neither "Lombard Street" nor "Threadneedle Street" nor any other locality would look at such a proposal. In practice interest and security frequently regard character as a negligible trifle.

PROCEEDINGS OF INSTITUTIONS.

The Steam-Gas Turbine.

(*Abstract of* THE JAMES WATT LECTURE, 1913, *delivered by* DR. S. Z. DE FERRANTI, *Past-President I.E.E., at Greenock, before the* JAMES WATT CLUB, *January 16th*, 1913.)

I HAVE chosen the subject of "Prime Movers" for the lecture, and have done so for several reasons. James Watt was practically the inventor of what we know as prime movers. This subject is, I think, the most interesting problem in engineering. It is also a subject which is more than ever interesting to-day on account of the active competition existing between the various systems of power production, and lastly, I have chosen this subject because it is the one which interests me above all others. You have had shown to you what splendid results Watt achieved, and what an immense effect these achievements have had upon the world's progress. You have, however, I think, heard little of what these achievements cost James Watt, and of the enormous difficulties he had to overcome in order to bring about the utilisation of his inventions. When at last he got some measure of assistance, there were endless mechanical difficulties to overcome, as in those days engineering practice was of the crudest possible nature. I consider that one of the greatest things ever achieved by James Watt was his discovery of Matthew Boulton; if it had not been for the magnificent support extended to him by Matthew Boulton, I cannot conceive how his inventions could have resulted in anything but failure and complete despair.

The same sort of thing is going on to-day in many directions. I am also afraid that in this country the difficulties of inventors are very great, owing to the want of interest in anything new. Although I think we have plenty of inventors, we have very few Matthew Boultons, and from the point of view of progress and development of the country, it is men such as he who are wanted to-day. It is generally believed that the immense development which has taken place in Germany is largely due to the intelligent use of her scientific men by the commercial community. In the United States there also appears to be a much better chance for the man who is desirous of developing new things, and this undoubtedly must help these countries to progress and keep ahead in the industrial struggle. It is vital to the progress of the country, in order that we should not fall behind our competitors, that great risks should be taken in the development of new ideas, and it would be a good thing for the country generally, if there were more keenness in this direction. I do not think that to-day this country is spending anything like enough in the development of new ideas.

In steam we have a power the whole of which is available for doing useful work. The power required for pumping the water into the boiler, which is the negative work of the cycle, is so small that it is almost negligible. Whatever the power given by the steam in the cylinder, less the friction of the engine it is available for doing useful work. It is, therefore, clear that however inefficient the engine may be, it will go round and do some useful work.

Although the Newcomen engine was in use before the days of Watt, it was exceedingly uneconomical, and his great work was the improvement of the efficiency of this engine to such an extent that it became useful and economical for general service. The greater part of the work done since his time has been in the same direction—viz., in a continual endeavour to improve the efficiency of conversion of the heat in the fuel into mechanical work.

With this object in view, higher steam pressures involving higher temperatures were introduced and compound engines, and later on triple expansion engines were developed to more effectively utilise the higher ranges of steam pressure. The work of Sir Charles Parsons in the invention and development of the rotary principle to the production of motive power by means of steam must ever be remembered as a great advance in the development of prime movers. The turbine, notwithstanding its very low efficiency as first constructed, was gradually improved until high mechanical efficiencies of conversion have been reached. Especially is the turbine valuable in the production of large powers and in taking advantage of high degrees of vacuum.

Before, however, the modern turbine had been developed, another idea had been pursued with a view to simplifying the process of power generation, and, at the same time, getting a higher economy. Years ago an engine was invented and built by Lenoir, in which a charge of air and gas was sucked into the cylinder at atmospheric pressure and exploded. The piston speed in this engine was low, the ratio of expansion was low, and, needless to say, the economy was very poor. Still, it was a step in the direction of higher economy, insomuch as by this system a higher temperature of working fluid was obtainable. Later on, Otto and Langen invented a gas engine, which was an improvement on the previous one as the pressure of explosion was higher and the ratio of expansion was greater. Both these engines, although of the explosion type, came under the heading of "low negative work," as the explosive charge was simply sucked into their cylinders, and was not compressed before firing.

The great move forward, which was next made, was that of compressing the charge of explosive mixture before firing, and so getting a high maximum temperature, a good ratio of expansion and, consequently, much improved economy. Engines of this type belong to a class of prime movers with "high negative work." In this form of engine the positive work of the explosion has to have deducted from it, not only the friction of the engine, but also the amount of work required to compress the charge which constitutes

the negative work of the cycle. There is a further deduction, viz., that of the friction of the engine or of a separate pump whilst doing negative work. These deductions are very serious and would render this class of motor useless, were it not for the high mechanical efficiency of the parts used for carrying out the cycle.

In the gas engine the negative work is high, but not so high as to form a serious difficulty. In the more economical Diesel engine in which very high pressures are used, so as to get a high enough temperature to burn the oil as sprayed into the cylinder and give a high ratio of expansion, the negative work is a much more serious difficulty.

The development of the internal-combustion engine of high negative work, which was started before the birth of the modern steam turbine, has been vigorously pushed on over a period of years concurrently with the work done on the turbine, and now both are competing for premier place in furnishing the world's power.

It seems, according to present knowledge, to be clear that for small powers the internal-combustion reciprocating engine is in every way the best. At the other end of the scale the turbine is the only means of filling our requirements to-day. In between these two extremes there is a doubtful dividing line where either form of engine may best serve the purpose, according to the conditions of the particular case.

As the turbine gets bigger, so is it easier to construct, and it also becomes more economical. As the gas or oil engine gets bigger I need hardly remind you how the natural difficulties increase. On the other hand, as the turbine is reduced in power its economy falls off badly and it is difficult to make a satisfactory design. The internal combustion engine, on the contrary, becomes a most satisfactory and economical machine in small sizes, as witness the thousands of gas engines in use all over the world and the beautiful engines working on the Diesel cycle which are small enough to avoid water cooling of the pistons.

I think that this division of the means of power production by large and small units between the rotary and reciprocating machine is almost a natural law, and those who seek to evade it must either invent some new principle or court endless trouble, expense and failure.

To-day, with a complete disregard of the above principles, the advocates of the Diesel engine for marine propulsion are spending vast sums of money on its development, but even this usually all-powerful force may not prove enough to make a wrong principle right. The daily Press and also our well-informed technical journals tell us of all the wonderful successes of large oil engines in Germany and elsewhere, but I can assure you that few people have any conception of the failures and breakdowns which have occurred, and which are repeatedly occurring, with the big experimental engines that have been constructed. In Germany, especially, where so much has been done in this direction, they carefully avoid informing the foreigner on these points.

As I mentioned to you at the beginning of this lecture, the subject of prime movers is one in which I have always been most interested, and in following it my constant aim has been to increase the amount of work that can be usefully obtained from a given amount of fuel. It is, of course, well known that the higher the temperature of the working fluid the higher is the economy that can be obtained. High temperatures have, however, proved very difficult to work with, and as an instance of this, the low working temperatures of turbines for marine propulsion may be pointed out. Seeing, however, that the difficulties were mechanical and that great advantage could be derived if these troubles were overcome, I commenced experimenting some years ago, and have now after many failures, and the expenditure of much money and time, produced a turbine which at the highest temperatures, and with great and rapid variations of temperature, is quite free from mechanical troubles. Indeed, I believe that this turbine is perhaps the strongest from a mechanical point of view that has yet been produced. Moreover, contrary to what might have been expected with a high temperature machine, it runs with certainty with a blade end clearance that is so small that it is almost negligible from the point of view of leakage loss, and the fear of the possibility of stripping appears to have been effectively removed.

In this turbine I superheat the steam initially, and after the first expansion, and whilst it is still superheated, resuperheat it before it does its work in the second stage of the turbine. After this it is exhausted in a superheated condition through a regenerator to the condenser. The whole of the blading is electrically welded, so as to avoid the straining due to caulking at the high temperatures that are reached, and also the loosening that occurs due to the same cause. The blading is formed of mild steel with a thin coating of pure sheet-nickel electrically welded on to the surface. The blading is most accurately finished to shape by a process of step-by-step pressing under very heavy pressure.

The blading, the sections of which are very exact, is welded in position with the accuracy of the automatic machine that is used for the purpose, and every opportunity is thus given for realising the best results. Although the turbine is of the reaction type, no balance dummy is used. The whole of the end load is taken on a specially constructed thrust, thus saving steam leakage.

The steam is worked as a gas at high temperature throughout the turbine, and this, coupled with the many improvements above referred to, has given very good results.

The 5,000-H.P. machine, which has now been running for some time, when tested at a load of two-thirds full power, has given a shaft H.P. on 7 lb. of steam, which, if supplied by an oil-fired boiler superheater system of 85 per cent. efficiency, which has already been exceeded in central station practice, would consume less than ·625 lb. of oil per shaft horse-power.

From many tests already made, it appears that when this turbine is run at full load under favourable conditions it will take less than 6 lb. of steam per shaft horse-power, and that the system under the conditions named will have a thermal efficiency of over 24 per cent. corresponding to an oil consumption of about ·55 lb. of oil per shaft horse-power. The tests are being proceeded with, but as the turbine is run continuously in supplying power to a large works with a constantly varying load, it is not easy to do what is necessary to enable tests to be carried out. So far as I can see, this system when applied on a large scale, will be capable of giving an overall thermal efficiency of 29 per cent.

When the advantages of the turbine system in the way of lightness, simplicity and certainty are borne in mind, and when they are compared with what is known of the complicated reciprocating oil engines now being introduced for marine purposes, the possibilities of the new system of high-temperature gas steam turbine become of great interest.

Steam as a practical motive power so brilliantly invented and applied by James Watt has had a long and most useful application in our civilisation, but it cannot be looked upon as the eventual solution of the power problem even for large powers. It can, however, be immensely improved in efficiency, and as it does not appear that there is any other system at present which will fill the same requirements, it is probable that it will still have an enormous application.

With a high-temperature steam turbine of large size generating electricity to supply power for all purposes on land one has the advantage of a machine of the highest efficiency which is not limited to oil for its fuel. It is probable that as improvements are made the whole of the coal used for firing these large units will be gasified, and the by-products recovered. When this result is brought about we shall have not only an ample and cheap supply of fertiliser for the land, but also a great quantity of the tar oils, which will form a suitable means of firing for naval purposes, and will relieve us from the necessity of purchasing fuel oil abroad and the risk and cost which this process involves. We will also have an ample supply of benzol for all our small motor requirements. This, I think, is the solution of the fuel problem for these motors rather than in the production of alcohol on a large scale from the land, as has lately been advocated. When we are supplied with ample quantities of fertiliser at a low cost, both the land and the labour involved for the production of alcohol will be much better occupied in other ways. After all, the great problem for this country is to so utilise the coal that we produce that we make it fill our every requirement. This, I have shown you, will be done in the not distant future.

The electric motor which gives its power in a rotary form, and which is supplied from very large power stations, is displacing all forms of small engine. It is, therefore, probable that in the future small prime movers will only be required to propel cars and boats, and that all stationary motors will be electric. The electric motor, with its one running part so easily and conveniently applied to all purposes, is a good illustration of the desirability, and even the necessity, of the rotary principle of engine. Reciprocating forms of engine will, no doubt, be used for a long time, but they can only be regarded as makeshifts, and so soon as an equally efficient machine for any particular purpose is developed, it must surely displace the reciprocating motor. No doubt, as knowledge increases, many forms of prime mover will be developed of higher and higher economy. It is difficult to predict the form of the prime mover of the future, but, in search of the highest economy, and with the limitations of temperature imposed by known materials, one is inclined to look to electricity converting the energy of the fuel at low temperatures, and giving its power in rotary form as the most likely eventual solution.

The Design of Apparatus for Improving the Power Factor of Alternating-Current Systems.

By MILES WALKER, M.I.E.E.

(*Abstract of paper read before the* INSTITUTION OF ELECTRICAL ENGINEERS, *London, January 9th*, 1913.)

THIS paper will be confined to a short statement of the principles involved and a description of the phase-advancer built by the British Westinghouse Co.

We may look at the cause of the lagging current in the following way:—The energy stored in any magnetic field consists of two factors—(*a*) the total flux; (*b*) the magneto-motive force driving that flux

Now, the total flux when created at a certain frequency produces a certain back E.M.F. in each turn encircling it, and the magneto-motive force requires for its production a certain number of ampere-turns. Thus, from the two factors—flux and magneto-motive power—we arrive at certain factors necessary for the production of the alternating magnetic field at any given frequency. These factors are:—(1) Electromotive force per turn; (2) number of turns; (3) amperes per turn.

Grouping 1 and 2 together, we arrive again at two factors—volts and amperes—whose product represents the idle component of the power required to generate all the alternating fields in the distribution system.

The higher the frequency of the supply the greater will be the idle component of the power required to produce the alternating field. If the field can be produced by a rotating magnet (as, for instance, in a synchronous motor) excited by continuous current, the frequency of the current being zero, no idle component is necessary. Indeed, by supplying more continuous-current turns than

are necessary to produce the magnetic field in any particular machine, it is possible to create in the system a leading current, which will compensate for a lagging current in another part of the system. The field current in the magnet of an alternator may be said to have two functions:—

1. To produce the magnetic field which generates the electromotive force in the alternator itself.

2. To supply an additional magneto-motive force, which by means of a wattless current is communicated to all the machines in the system that have not got continuous-current excitation themselves.

If we are to reduce the wattless current we must either use machinery requiring weak magnetic fields, or we must provide independent means of magnetising the fields. A modern transformer does not take a large wattless component in proportion to its output, because, though the total flux generated may be great, the magneto-motive force required to produce that flux is very small. An induction motor, however, having necessarily an air-gap and coils of considereble magnetic leakage, has in it a magnetic field which requires a wattless component of 25 to 30 per cent. of the kilovolt-ampere rating of the motor. For this reason the induction motor is the main cause of low power-factors in our alternating-current systems.

If now the magnetising current of an induction motor can be supplied at the frequency of the slip (say, one cycle per second), instead of at the frequency of supply (say, 50 cycles per second), the wattless magnetising kilovolt-amperes are very much reduced.

In 1895, M. Leblanc proposed to supply the magnetising current to the rotors of induction motors and generators by means of special exciters, which consisted of commutating alternating-current generators whose magnets were excited by the rotor currents.

The main objection to the method, as described in Leblanc's early patent, is that it requires two or three exciters, and as the currents to be dealt with would in general be large, the cost of these exciters becomes excessive. Leblanc has described an exciter which embodies in one machine all phases, and is of a very simple nature. This is illustrated in figs. 1 and 2, which show two-pole armatures, one arranged for two-phase and one for three-phase.

The armature is made like an ordinary drum-wound continuous-current armature. It is surrounded by a simple ring of laminations, having inwardly projecting poles, but without any field windings. The notches in the field are to aid commutation. If such an armature, as illustrated in fig. 1, be provided with four brushes, placed at 90° to one another on the commutator and connected to the four slip-rings of a two-phase rotor of an induction motor, and is run at a speed which is high as compared with the frequency in the rotor circuits, it will have the effect of producing leading currents in the rotor. The beauty of this exciter is that the armature currents themselves excite the field, and produce a flux in the armature which is in such a phase as to generate an E.M.F. in each circuit, exactly at right angles to the current carried by that circuit. For, at the instant when the maximum current is going into the armature by brush A_1 and out at brush A_2, the armature will be magnetised with one pole at the top and another pole at the bottom, so that no E.M.F. is generated in phase A, but a

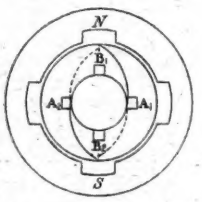


FIG. 1.—LEBLANC'S TWO-PHASE EXCITER.

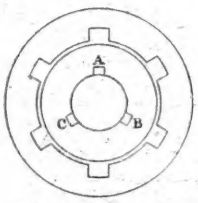


FIG. 2.—LEBLANC'S THREE-PHASE EXCITER.

maximum E.M.F. is generated in phase B. Thus we see that the E.M.F. in any phase is always at right-angles to the current in that phase. The question whether the E.M.F. leads or lags behind the current depends only on the direction of rotation. Such an exciter can be built for three phases, as illustrated in fig. 2, and would be much cheaper to build than three separate exciters. By proper design, and by using carbon brushes, the commutation can be made sufficiently good; but in view of the fact that the rotors of induction motors of large power usually carry very heavy currents, the commutator of such an exciter, say, for a 1,000-H.P. motor, would be of considerable dimensions.

A. Scherbius, in a recent communication, gave an illustration of a phase advancer of this type made by Messrs. Brown, Boveri & Co., capable of bringing to unity power-factor a 600-H.P. motor. This machine is illustrated in fig. 3. The overall dimensions of this set are 50 in. × 22 in. × 25 in., and its weight 750 lb. The cos ϕ curves of a 400-H.P. 32-cycle motor running at 160 R.P.M. both with and without the advancer are given in fig. 4.

It will be recognised that the stationary iron frames in figs. 1 and 2 are not really necessary, except in so far as they may reduce the magnetic reluctance of the magnetic circuit when an open slot-winding is used on the armature. If a winding with closed slots is used, the magnetic circuit may lie wholly within the armature. While the armature rotates, the field remains stationary as long as a continuous current is supplied to one set of brushes. If currents slowly alternating, such as those from a rotor winding, are supplied, the field slowly revolves in space while the rapidly revolving armature conductors cut across this field and generate the necessary leading electromotive forces. An exciter of this kind, having no external field, has been made by Messrs. Brown, Boveri & Co. The use of the external frame, however, seems to possess several advantages; it enables open slots to be used on the armature, and by fixing the position of the field independently of the currents carried by the armature, enables the commutation to be performed in a thoroughly satisfactory manner.

It should be pointed out that the main reason why the phase-advancer has a fair chance of commercial success is that it is a machine of small output in comparison with the amount of change of wattless load which it is capable of effecting when used in conjunction with an induction motor of suitable size. A phase-advancer of only 30 K.V.A. capacity is capable of changing the power-factor of a 1,300-K.V.A. motor from 0·88 lagging to 0·95 leading. That is to say, the motor instead of requiring to be fed with lagging wattless current to the amount of 600 K.V.A. will relieve the generators supplying the system of a wattless load of 400 K.V.A., making a total change in the wattless power of 1,000 K.V.A. to the good. The reason is that the phase-advancer stands in the same relation to an induction motor as an exciter does to a synchronous motor. An exciter of comparatively small capacity can over-excite a synchronous motor so as to make it supply a wattless load 50 times as great, measured in K.V.A., as the rating of the exciter. Now, if for some mechanical work a large induction motor must be employed, the extra cost of making that motor run at unity, or even at a leading, power-factor is not very great. It is merely a question as to the cost of an advancer whose rated output is some 3 to 6 per cent. of the rating of the motor, and the cost of a three-phase double-throw switch for putting it in and out.

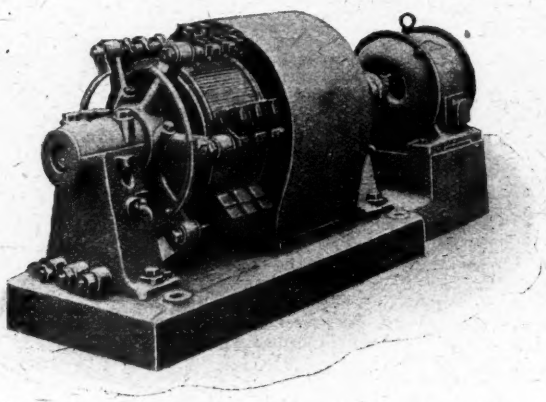


FIG. 3.—SCHERBIUS PHASE-ADVANCER.

The armature may either be of the open-circuit star type or of the closed-circuit type. Both kinds of armature commutate well. The first (fig. 5) is suitable when the current to be collected on the commutator is very great and the voltage to be generated is small, say not more than 15 volts. It enables a very wide brush (extending

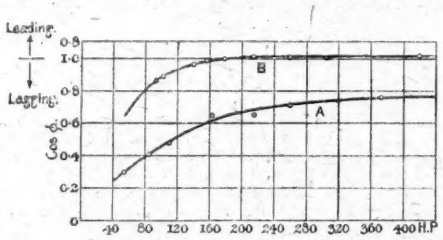


FIG. 4.—POWER-FACTOR CURVE OF A 400-H.P. MOTOR; A, WITHOUT THE PHASE-ADVANCER; B, WITH THE ADVANCER IN CIRCUIT.

over 0·7 of the pole pitch) to be used. The second type (fig. 6) is suitable when the current is not very great and the voltage is higher. The illustration given in fig. 11 relates to a machine with a closed armature winding. The design is identical with that of some smaller machines of 6-K.V.A. rating now running in commercial service, but the dimensions shown are suitable for an advancer of 30-K.V.A. output.

The cases that will be found most suitable for the addition of phase-advancers to induction motors are those where the motors are intended to run continuously in one direction throughout the greater part of the day. If a motor is intended to be started and stopped frequently, or reversed, then it is not suitable.

Let us suppose that we wish to design a phase-advancer to be direct-connected to an 800-H.P. induction motor driving a continuous-current generator. If the motor has already been built, it is necessary to inquire whether its rotor is provided with a winding brought out to slip-rings; and if so, whether the slip-rings and brush gear are designed to carry the full-load current continuously. One could adapt a phase-advancer to almost any normal rotor winding (except, of course, a short-circuited winding); but if the

current is very high and the voltage low, the cost of the advancer will be greater than where the current is fairly small and the voltage higher.

Suppose that the rotor has a three-phase star-connected winding having a stand-still pressure of 800 volts per phase. The working current (that is to say, the current in phase with the voltage) will then be about 255 amperes, which can be collected on a comparatively small collector. To find the rotor current necessary to

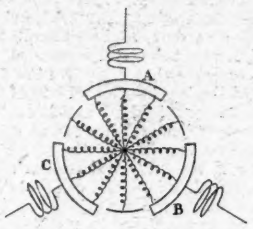


FIG. 5.—DIAGRAM OF OPEN-CIRCUIT ARMATURE WITH SEVERAL BRANCHES IN PARALLEL UNDER WIDE BRUSH BELONGING TO EACH PHASE.

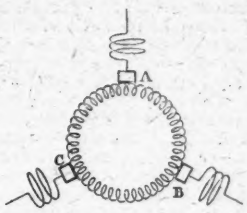


FIG. 6.—CLOSED-CIRCUIT ARMATURE FORMING A MESH CONNECTION BETWEEN THE PHASES.

make the motor run at 0·95 leading power factor, proceed as follows:—

Set off a vertical line representing 255 amperes, as shown in fig. 7. The power factor of an 800-H.P. 50-cycle motor running at 490 revs. per minute might be about 0·88, so that without the advancer one would have a lagging current equal to 47 per cent. of the working current. If the advancer caused the rotor to take a leading current of 47 per cent. (that is, 120 amperes), the power factor at the stator terminals would be nearly unity. If now it is desired to make the power factor at the stator terminals 0·95 leading, we must supply to the rotor an additional 31 per cent. of leading current, making 200 amperes wattless in all. Adding as

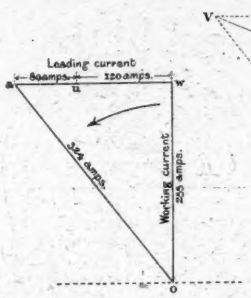


FIG. 7.—CONSTRUCTION FOR FINDING VALUE OF ROTOR CURRENT REQUIRED TO PRODUCE A GIVEN LEADING POWER FACTOR.

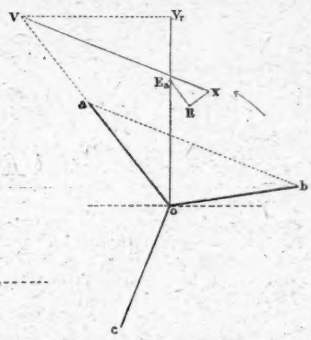


FIG. 8.—CONSTRUCTION FOR FINDING THE VOLTAGE REQUIRED TO BE GENERATED BY ADVANCER.

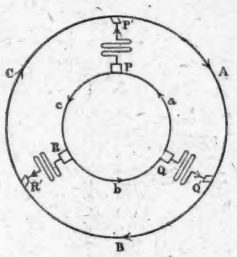


FIG. 9.—DIAGRAM OF CONNECTIONS.

Mesh-connected phase-advancer armature *a*, *b*, *c*, field connections P, Q and R, and mesh-connected rotor A, B, C of induction motor.

vectors the 200 amperes wattless to the 255 amperes working current, we get 324 amperes per phase for the rotor when running under these conditions. This is the current for which the advancer must be designed. If we had made the rotor with a voltage per phase of 400, we should have had 650 amperes, which would have made a somewhat more expensive, though perfectly possible, phase-advancer.

Next as to the voltage to be generated by the advancer. As the armature of the advancer is to be mesh connected, it is simpler to take the voltage across the slip-rings than the voltage per phase of the star winding. Indeed, as the motor would work the same whether it were mesh connected or star connected, we may, if we like, consider it mesh connected, as we have done in fig. 9. If the normal slip of the motor at full load be 1·45 per cent., the E.M.F. generated by the slip will be 20 volts measured between rings. Lay off, as in fig. 8, the vertical line o E_a to represent this voltage generated by the slip in phase A. In fig. 7 we have found the angle by which the current must lead on this voltage, so we can set off the line o *a* to represent the current in phase A (see fig. 9). Similarly, o *b* and o *c* represent the currents in the other phases. We should allow about 6 volts for pressure drop in brushes and in the resistance of the advancer. This will be represented by E_a R in phase with o *a*. Then there will be some reactive drop in the field coils of the advancer. We may provisionally allow 5 volts for this, and after the machine is calculated we can make a check calculation to see if it is enough. This is represented by R X. There is no reactive drop in the armature because the compensating winding wipes out its field. We see that if we add a voltage X V, parallel to *b a*, we shall get a resultant voltage o V in phase with o *a*, and this is what we want. If, therefore, we excite the advancer with a current which is in phase with the sum of o *a* and — o *b* (shown by the dotted line *b a*), we can make the current lead by the right amount. The voltage to be generated by the advancer is therefore given by X V, which, when scaled off, gives us 33 volts. It will be seen that the projection of o V on the vertical line gives us o V_r, which is greater than o E_a. If this voltage o V_r is greater than is necessary to drive the working current through the rotor circuit, the only effect will be that the slip of the rotor will be reduced until we get the right working current for the load. If it should come out that o V_r is not sufficient to drive the working current, then the slip of the motor will be increased.

From fig. 8 it appears that with 33 volts generated by the advancer the slip will be slightly reduced. We thus arrive at the rating of the advancer, namely, 33 volts between terminals and 324 amperes per phase.

It will be found that the series-wound advancer will have more suitable characteristics for the case in hand than a shunt-wound advancer. With a series excitation the amount of leading current taken from the line increases with the load, so that the power factor of the motor remains more nearly constant than where the excitation of the advancer remains constant. We will therefore decide upon a series winding. When the voltage to be generated is of the order of 30 volts or higher, and the current is reasonably low, as in this case, the best kind of armature is that with a closed winding, just like an ordinary continuous-current armature.

Theoretically, three salient poles (equivalent to two magnetic poles) are quite enough for a machine of the rating required in this case, but a machine of six poles (equivalent to four poles magnetically) is more likely to fit in with standard frames and standard punchings. This will give us six brush arms, two in parallel in each phase. There will be 162 amperes per brush arm, and 162 ÷ 1·73 = 94 amperes per conductor.

As the speed of the main motor in this case is quite high, 490 R.P.M., it is quite a good plan to couple the advancer directly to it, just as one would an exciter to a high-speed synchronous motor.

If we take a large D^2 L constant of 9·5 × 10^5 cb. cm. it will not be excessive, though very ample. A diameter of 46 cm. is suitable for a speed of 49 R.P.M., and the length of iron may be 18 cm.

The easiest way of designing a phase-advancer of this type is to proceed as if it were a continuous-current machine whose voltage is 1·41 times greater than the virtual voltage called for in the specification. The armature need not differ in any particular from a continuous-current armature. The field winding will be provided with series exciting coils and compensating windings connected to the various phases in the manner described below.

The main points to look to, that are not found in a continuous-current design, are:—

1. The machine though having six salient poles is a four-pole machine magnetically, and we must remember this when fixing the dimensions of the iron behind the slots.

2. The voltage to be generated as a continuous-current machine is 1·41 times greater than the virtual voltage called for.

3. The fluxes in the salient poles which constitute magnetically a pole-pair are 120° apart in phase, so that the voltage generated in an armature coil which lies partly under one pole and partly under another is only 0·86 of the voltage that would be generated if the two poles were carrying the maximum flux at the same time.

4. It is necessary to arrange the series winding on each pole so as to cause the flux to lead, by the right amount, ahead of the current carried by the armature conductors passing under the pole.

5. It is desirable to arrange the compensating winding so that its effect is equal and opposite to the armature winding adjacent to it, and for this purpose it is necessary to have regard to the phases of the currents in the armature and field.

6. It is desirable to provide a commutating flux which shall be proportional to, and in phase with, the current to be commutated.

We begin, then, just as we would on a continuous-current generator. The voltage to be generated is 33 × 1·41 = 46·5 volts. There are six ways through the armature, each carrying 94 amperes. If we choose 72 slots with four conductors per slot we get 288 conductors, and these multiplied by 94 give us 27,000 ampere-wires, a fairly easy current-rating for an armature 46 cm. in diameter.

If we denote the area of the cylindrical working face of the armature by A_g and the maximum flux density in the gap by B, then we may take the magnetic-loading as proportional to A_g B. If we have a pole-arc equal to 0·72 of the pole pitch, then as there are 48 conductors in series and the speed is 8·2 revs. per second—

$$46{\cdot}5 \times 10^8 = 0{\cdot}72 \times 8{\cdot}2 \times 48 \times A_g\,B \times 0{\cdot}866.$$

Observe the multiplier 0·866, which comes into the equation on account of the circumstance mentioned in paragraph 3, above.

Thus we arrive at the magnetic-loading A_g B = 0·189 × 10^8. If we work the iron in the teeth at 18,500 lines per sq. cm., we shall require a total mean cross-section of all the teeth of 1,020 sq. cm. Our conductors, to carry normally 94 amperes and 25 per cent. overload, may be made 0·23 by 1·27 cm. Four of these will require slots about 0·77 × 3·7 cm. To provide room for 72 slots and give the necessary cross-section to the teeth we shall require a net length of iron of 16·4 cm. Allowing 11 per cent. for paper on the punchings and 0·6 cm. for a ventilating duct, we arrive at a gross length of iron of 19 cm. The rest of the calculation of the armature is the same as for a continuous-current machine, except in the matter of commutation, which we will consider later.

We must now consider how we are to wind the field poles so as

to give to the excitation its proper phase. The first point to note is that the six armature circuits are connected in mesh, while the leads from the brush-holders are connected in star.

In fig. 9 we have a diagram of connections as they would be if the machine had only three brushes. Obviously this diagram applies equally well to the machine with six brushes where brushes at opposite ends of a diameter are in parallel with one another. The inner circle of fig. 9 represents the closed winding of the armature of the advancer. The small letters a, b, c show the three phases mesh connected. Three brushes—P, Q and R—bear on the commutator and convey the currents to the outer circle, A, B, C, which represents the winding of the rotor of the induction motor taken as mesh connected. The arrowheads show the direction along each conductor which is taken as positive for the purpose of our clock-diagram, fig. 8. P, Q and R are in star, and it is only in series with them that we can connect the series exciting coils. The voltage in phase A of the rotor is the voltage we would measure by connecting a voltmeter to the collecting brushes P′ and Q′. In order to make the current in this phase lead, it is necessary to generate a leading electromotive force in the part a of the armature circuit. From fig. 8 we found that a suitable E.M.F. to inject into phase A was the E.M.F. X V, which is in phase with $(a - b)$. From fig. 9 we see that the current in Q is $(b - a)$, so that $-$ Q is $(a - b)$. We will, therefore, excite the poles under which coils a are passing with $-$ Q. The span of the armature coils is almost a pole pitch, so that the coils in phase a will be passing under two adjacent poles, which we will call pole P″ and pole Q″. Now, it is not convenient to use only the conductor Q to excite P″ and Q″, because we have to arrange for return paths and also for a compensating winding, and we want to make a fairly simple mechanical arrangement of the coils. We, therefore, take advantage of the known fact that currents P + Q + R = 0: therefore, Q = $-$ P $-$ R. Let us make an arrangement of exciting windings and compensating windings

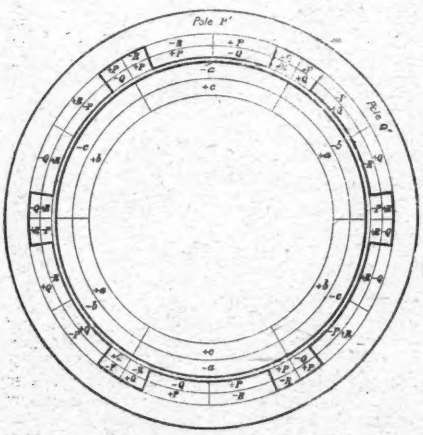


FIG. 10.—SHOWING RELATIONS OF EXCITING WINDINGS AND COMPENSATING WINDINGS TO ARMATURE WINDINGS.

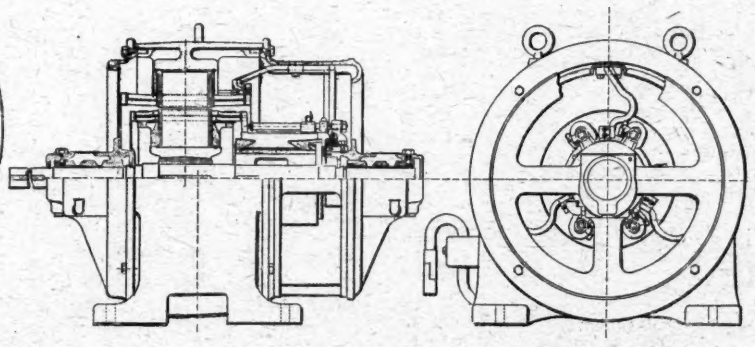


FIG. 11.—PART SECTIONAL ELEVATION OF PHASE-ADVANCER.

like that indicated in fig. 10. There the exciting conductors which pass between poles P″ and Q″ are + Q, + Q, $-$ P, $-$ R. That is to say, they are equivalent to 3 Q. The question whether the excitation + Q gives a forward or a backward E.M.F. in a coil depends upon the direction of rotation, and also upon the question whether the armature is wound right-handedly or left-handedly. It will be seen that this arrangement of conductors lends itself to form mechanically a simple barrel winding. The conductors lie in two layers, and all the end connectors of one layer are bent to the right, and all the end connectors of the other layer are bent to the left.

The letters in fig. 10 which are placed on the salient poles represent the compensating windings. It is easy to prove that these are in direct opposition of phase to the currents in the armature under the pole. For instance, take the pole P″. The compensating winding on this is, + P + P $-$ R $-$ Q, or + 3 P. Now the armature coils which lie under P″ are c and $-$ a, and we know that $a - c$ = + P. Moreover, the 16 conductors in the pole face carrying the currents P, Q, and R are equivalent to 12 conductors carrying the P current. Opposite the pole P″ are 12 armature slots each carrying—2 a and 2 c. When we remember that there are two paths in parallel per phase in the armature we see that the currents in these 12 slots are exactly balanced magnetically by the 12 P currents in the compensating winding.

In practice it will be found unnecessary to adjust the speed exactly, because the particular power-factor at which the motor runs is not a matter of importance. It is not usually necessary to make any provision for the adjustment of the power-factor during running; it is sufficient that the motor shall take a leading current from the line at all loads. If it should be necessary to adjust the power-factor, this can be done either by changing the speed of the advancer or by diverting some of the field current from the series coils.

In cases where the speed of the motor is not great, it is more economical to belt the advancer to it so as to obtain a higher speed. In other cases the advancer may be run from any convenient countershaft in the mill where it is used, or it may be directly connected to an independent motor.

The most important consideration of the design of the phase-advancer is the obtaining of good commutation. It is chiefly for this purpose that the field frame and winding described in this paper are provided. Where, in a continuous-current generator, the voltage between the bars is small, the commutation can generally be forced by the resistance of the carbon brushes; but it is very much more desirable to provide a commutating E.M.F. which shall at all times be proportional to the current to be commutated. In the machine here described this result has been effected by giving each armature coil a span of somewhat less than the full pitch, and arranging the positions of the brushes so that one of the limbs of each coil is moving in the fringing field of a pole excited by a current which is at all times proportional to the current under commutation. The currents in the two branches of the armature, a and $-$ c, which combine to form P, are out of phase with one another, and are not directly under control of the commutating flux; but the rate of change of the current in the coil under commutation ought at all times to be proportional to P. Now the pole P″ (fig. 10) is excited so that the fringing field in which the left-hand limb of the coil a is moving is at all time proportional to P. By making the coil with a short throw, the right-hand limb can be taken out of the influence of the pole Q″. The exact position for the brushes is, of course, obtained by trial; in practice it is found that the commutation is perfect. The alternation of the current in the armature and field causes a harmful E.M.F. to be set up in each coil under commutation; but as the frequency is so very low (say, one cycle per second), this E.M.F. is not sufficiently great to create any disturbance. In the machine under consideration it only amounts to one-sixth of a volt.

In a certain mill in the North of England there is a 250-KW. generator which on account of the low power factor of the motors connected to it is somewhat overloaded. As it would be a rather costly undertaking to install a new generator, the alternative proposition was put forward of connecting a phase-advancer in circuit with the rotor of a certain 140-H.P. motor in the mill. It was seen that this at least would help matters, although the capacity of the motor and its phase-advancer were not great enough to bring the power factor up to unity. A 5-K.V.A. advancer was installed, with the result shown by the following figures:—

TOTAL LOAD ON MILL.

	Amperes per phase.	Volts.	Power factor.
Advancer cut out	325	440	0·70 lagging
Advancer connected in ...	240	440	0·92 lagging

MOTOR LOAD ONLY.

Advancer out	105	440	0·74 lagging
Advancer in	97	440	0·96 leading

Whenever the advancer was switched in the volts of the generator rose from 440 to 470. The figures in the above table were taken after the rheostat had been adjusted to make the voltage normal.

Another case that might be quoted is that of three 400-H.P. motors installed for pumping water for the Port of London. As the speed of the motors is low the normal power factor at full load is only 0·55. These machines have been fitted with phase-advancers, with the result that they run on a slightly leading power factor.

The table on page 158 gives the result of tests upon a 750-H.P. motor running under various conditions with and without a phase-advancer.

In the case of readings 1 and 2, the voltage was maintained constant by hand regulation. The rise of voltage between readings 3 and 4 is due to the phase-advancer yielding a leading magnetising current. It will be seen that when the first reading was taken

the phase-advancer was not running, and the power factor of the motor was then 0·86 lagging. The next two readings show that with the aid of the phase-advancer the power factor has been brought up to unity, whilst in the case of some of the lower readings, with the aid of the phase-advancer, the power factor has been changed to 0·5 leading.

Reading.	Volts.	KW.	Power factor.	Remarks.
1	1,840	280	86 % lagging	Phase-advancer not running
2	1,840	300	Unity	Phase-advancer running
3	2,200	375	Unity	Phase-advancer running
4	2,600	375	80 % leading	Phase-advancer running (increased speed)
5	2,000	20	50 % leading	Phase-advancer running (speed as before)
6	2,600	312	40 % leading	Phase-advancer running (increased speed)
7	2,560	20	5 % leading	Phase-advancer running (speed as before)

The motor on which these experiments were tried formed part of a motor-generator set, and it was therefore possible to make it run as an induction generator by speeding up the continuous-current machine. When this was done the terminals of the phase-advancer were reversed so as to give the right rotation phases relatively to the rotor winding. It was found that the induction generator could be run so as to supply a lagging wattless load, the magnetisation of the motor being carried out by means of the rotor current. In another case a phase-advancer was connected to the rotor winding of a 750-H.P. motor driving a rolling mill. The load on this mill was very unsteady, and for considerable intervals of time was so light that the motor was running on an extremely low power factor. The effect of the phase-advancer was to make this induction motor take a small leading current at all loads. Before the installation of the advancer the whole works took a load of about 1,000 K.V.A. at 0·64 power factor; when the advancer was started up this was changed to 800 K.V.A. at 0·8 power factor. In cases where generators are overloaded and it is not desirable to install large machines, a considerable advantage can sometimes be obtained by the use of a phase-advancer in conjunction with a large motor on the system.

AUSTRALIAN WIRELESS TELEGRAPHY.

THE Commonwealth Commissioner of Patents on October 15th, 1912, granted letters patent to Mr. J. G. Balsillie, the Commonwealth wireless expert, with respect to his system of wireless telegraphy, which is assigned to the use of the Postmaster-General.

The description and drawings of the transmitter and receiver, as published in the Australian Official Journal of Patents, are as follows:—

A transmitting system, in which tuned primary and charging circuits energise an exciting circuit, which, in turn, delivers unidirectional impulses or kicks to an electrostatically-coupled radiator circuit.

The exciting circuit is characterised by being provided with more than two condensers, one of which is common to the radiator circuit.

The unidirectional impulses are obtained from the exciting circuit by the use of an air-blast gap, working with a pressure of 100-105 lb. per sq. in.

In fig. 1 the primary circuit, consisting of the alternator A, key B, primary C of step-up transformer, and reactance D, is inductively coupled to, and in tune with, the charging circuit, consisting of the transformer secondary E, reactance K, and condensers F, G and H.

The exciter circuit comprises the rectifying discharge gap J (consisting of nozzle and plate electrodes L and M), the reactance K, and condensers F, G and H, it being essential that the condensers F and G are arranged symmetrically, one in each connection of the exciting circuit to the radiator circuit.

The radiator circuit consists of the antenna P, variable inductance Q, condenser H, and earth X.

In operation, the constants of the exciting circuit are so adjusted that it has no distinctive frequency of its own, in order that the radiator may freely oscillate in its own time period.

In an alternative form, a rearrangement of the condensers is shown, permitting the omission of the variable inductance Q.

In an absorber of the looped type, fig. 2, the extremities of which are connected to earth, one or both legs include a variable condenser, around which is shunted a closed oscillation circuit, tuned to the oscillation frequency of the received waves, and provided with a variable inductance, forming the primary of a transformer. The secondary of this transformer is included in a detector circuit, adapted to be tuned to the group frequency of the received waves.

The receiver may thus be tuned to receive from any particular transmitter, working on the two-tone principle, and emitting two distinct wave trains of different frequencies, but having a certain predetermined group frequency. The circuit is formed with a variable reactance X, Z, in each leg. Adjustable condensers C and Y are adapted to be varied coequally with condensers D and W respectively, the latter being included in closed oscillation circuits, each of which forms a shunt to condensers C and Y respectively. These circuits are adapted to be tuned in resonance with the absorbing loop, and, therefore, oscillate in the oscillation frequency of the received waves.

The variable inductances, E, E^1, respectively included in each shunt circuit, form the primaries of a transformer, the secondary, G, of which forms part of a detector circuit, which is thus responsive to any oscillation frequency in either shunt circuit through the

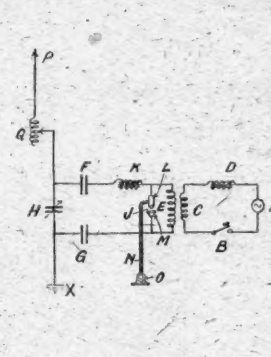


FIG. 1.—WIRELESS TRANSMITTER.

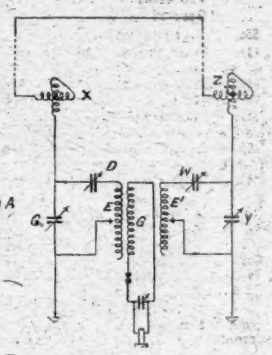


FIG. 2.—WIRELESS RECEIVER.

medium of the inductive coupling, but swings in its own time period, which is determined by the adjustment of its condenser, at a rate which corresponds to the group frequency, and not to the oscillation frequency of the received waves.

In an alternative form, one closed oscillating shunt circuit only is shown, to which the detector circuit is inductively coupled, as in fig. 2.—*Australian Mining Standard.*

Telephones in Rural Districts.—It will be remembered that, under the present farm telephone system, several persons in rural districts are enabled to share a single telephone line, running through an estate or district, at considerably reduced rates. This party-line system, of course, destroys privacy of communication, but has rendered an important service to agriculturists and others by providing full telephone benefits in other respects at a rate which is, at least, proportioned to some extent to the less urgent need for telephone service in these districts. Though a farmer has not the same kind of need for a telephone as a city man, the value per call is probably greater to him, owing to the greater distances involved and the absence of other rapid means of communication.

In rural areas, the commercial advantages of telephone facilities are great; market fluctuations can be followed, and sales and purchases effected, but it is in commercial transactions that the lack of privacy of the party-line system is really most serious. Socially—where distances between neighbours are great, and other means of communication practically impossible in inclement weather—the telephone comes as a great boon. In at least one case, the tedium of an isolated farmhouse has been relieved by the transmission of gramophone songs and music from the house of a neighbouring subscriber. Finally, the ability to summon prompt assistance in case of fire, accident or other emergency cannot be over-estimated, and must save many lives and much property in the course of a year.

The Western Electric Co. have lately introduced an economical telephone system, suitable for use on large and small estates and holdings, whereby a line is run round the estate, starting at the manor house or office, where a public telephone set is installed side by side with the local or "home" instrument. The occupier of every holding, and the various estate employés, can call any other station in the local circuit, a simple ringing code being arranged to discriminate between the calls intended for one station and those for another. Under the present Post Office regulations, private telephone circuits may not be directly connected to the public telephone system, but arrangements can easily be made to retransmit messages from stations connected only to private telephone lines at a central station connected to the public network, as well as to the party-line, and hence provided with two instruments.

An interesting installation on this system has lately been erected on Messrs. Farrow's general produce farm, near Spalding, Linc., and various parts of the equipment are illustrated in our contemporary, the *Fruit Grower, Fruiterer and Florist.* Ten stations, including the central office, on this farm (which is considerably over 1,000 acres in extent) are connected by 19 miles of local circuit carried on creosoted poles varying from 45 to 22 ft. in height. All the telephones are of the magneto-ringing type, and have powerful five-magnet generators. Wall sets are used except in the central office, where a table set is used for convenience, the ringing-magneto and call bell being arranged in a separate box.

NEW PATENTS APPLIED FOR, 1913.

(NOT YET PUBLISHED.)

Compiled expressly for this journal by MESSRS. W. P. THOMPSON & Co., Electrical Patent Agents, 285, High Holborn, London, W.C., and at Liverpool and Bradford, to whom all inquiries should be addressed.

318. "Blow magnet for arc lamps." KÖRTING & MATHIESEN AKT.-GES. (Convention date, May 11th, 1912, Germany). January 6th. (Complete.)

331. "Processes of electric welding." G. GNUCHTEL. January 6th.

333. "Sparking plugs." J. H. RUNBAKEN. January 6th.

356. "Electric welding." L. M. WATERHOUSE. January 6th.

411. "Disinfecting apparatus for telephones and the like." L. BLOCK. January 6th. (Complete.)

415. "Manufacture of quartz articles." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States) January 6th. (Complete.)

444. "Resonating relays." H. VON KRAMER and G. KAPP. (Addition to 10,856, 1911, and 5,950, 1912.) January 7th.

458. "Hoisting gear, winches or the like, operated by electric motors." D. WILSON. January 7th.

465. "Magnetometers, compasses, and the like." R. W. PAUL. January 7th.

505. "Connections between wires and cables of small diameter." A. FODOR. January 7th. (Complete.)

508. "Means for improving the illuminating effect of electric and gas lamps." W. J. BEVILLE. January 7th.

520. "Guide attachment to trolley poles of electrically-propelled vehicles." J. HILL. January 8th.

534. "Electric ceiling roses." J. P. SMITH. January 8th.

576. "Means for and methods of increasing the frequency of alternating currents." A. M. TAYLOR. January 8th.

584. "Arrangements for compounding alternating-current machinery." SIEMENS BROS. DYNAMO WORKS, LTD., and W. MARDEN. January 8th.

608. "Automatic single-pole electric switch." W. E. GORTON. (Convention date, May 16th, 1912, United States.) January 8th. (Complete.)

609. "Disinfecting apparatus for telephones and the like." L. BLOCK. January 8th. (Complete.)

622. "Vapour electric current rectifying apparatus." F. CONRAD. (Convention date, January 10th, 1912, United States,) January 8th. (Complete.)

633. "Wireless transmission of energy." A. ROLFE. January 9th.

647. "Primary batteries." H. E. FRY. January 9th.

664. "Electrical signal system in connection with tramway single lines with loops, or any electric traction, either along the public thoroughfare, in mines, or on permanent railways." E. LAWTON. January 9th.

672. "Connection of motors of electric tramcars or other rail carriages to prevent side swing." I. BULVIN. January 9th.

687. "Apparatus for controlling synchronous motion electrically from a distance." SIEMENS-SCHUCKERT WERKE. (Convention date, August 2nd, 1912, Germany.) January 9th. (Complete.)

735. "Means for collectively actuating and controlling alternating-current motors." J. L. ROUTIN. January 9th. (Complete.)

736. "Radiating system for signalling by electric waves from aeroplanes." SIGNAL-GES, m.b.H. (Convention date, February 24th, 1912, Germany.) January 9th. (Complete.)

745. "Starting and regulating devices for electric motors." A. H. OLMSTED and L. BOOTHMAN. January 9th.

749. "Improvements in and in means for use in electroplating." H. B. SANKEY. January 10th.

763. "Electrical terminals." J. W. RECORD. January 10th.

764. "Electrical switches." W. C. HORNE. January 10th.

770. "Storage battery plates." W. M. MCDOUGALL. January 10th. (Complete.)

786. "Method of telegraphy by low voltage currents converted by an induction coil into high voltage currents and a double current key for making momentary contacts." R. P. MACDOUGALL. January 10th.

788. "Method of and means for effecting the efficient transmission of electric signalling impulses through conduction wires and cables." A. WILLIAMS. January 10th. (Complete.)

790. "Motors for use chiefly in connection with telegraph transmitters." J. S. WITHERS. (K. C. Cox, Norfolk Island.) January 10th.

791. "Automatic telegraph transmitters." J. S. WITHERS. (K. C. Cox, Norfolk Island.) January 10th.

792. "Electric measuring instruments." H. ARON ELEKTRICITATSZAHLER-FABRIK G.M.B.H. (Convention date, August 28th, 1912, Germany.) January 10th. (Complete.)

793. "Arc lamps." BRITISH THOMSON-HOUSTON CO., LTD. (General Electric Co., United States.) January 10th.

800. "Accumulator containers." H. HUNTE. January 10th.

802. "Means for generating alternating electric currents." G. MARCONI. January 10th.

809. "Wireless telegraphy and telephony." S. G. BROWN. January 10th.

818. "Selecting devices for telephone circuits," SIEMENS BROS. & CO., LTD., and T. PETTIGREW. January 10th.

832. "Dry galvanic cells." J. A. E. ACHENBACH. January 10th. (Complete.)

853. "Control of electric motors and dynamos." T. & J. JACKSON, LTD., and J. JACKSON. January 11th.

866. "Electric furnaces for fixing nitrogen from the air." G. HARKER and E. K. SCOTT. January 11th. (Complete.)

882. "Electricity meters." W. LAWSON. January 11th.

883. "Time-limit devices for circuit-breakers and the like." J. ROOTHAAN and FERRANTI, LTD. January 11th.

886. "Electrical resistances." O. L. PEARD. January 11th.

896. "Carbon feed mechanism for electric arc lamps." CROMPTON & Co., LTD., and C. CROMPTON. January 11th. (Complete.)

PUBLISHED SPECIFICATIONS.

Copies of any of the Specifications in the following list may be obtained of MESSRS. W. P. THOMPSON & Co., 285, High Holborn, W.C., and at Liverpool and Bradford; price, post free, 9d. (in stamps).

1911.

WALL PLUGS OR OTHER COUPLINGS FOR ELECTRICAL PURPOSES. V. C. H. Gibson. 28,837. December 21st. (Cognate application, 12,909 of 1912.)

CONTROLLERS FOR ELECTRIC MOTORS. P. S. Turner. 29,138. December 27th.

MAGNETIC SEPARATORS. Fried. Krupp Akt. Grusonwerk. 29,224. December 28th. (January 12th, 1911.)

PORTABLE ELECTRIC BATTERY LAMPS. Edmundson's Electricity Corporation Ltd., J. S. Highfield and F. E. Gripper. 29,309. December 29th.

1912.

DYNAMO-ELECTRIC GENERATORS. British Thomson-Houston Co. and E. Garton. 4,529. February 22nd.

MARINERS' COMPASSES. L. W. P. Chetwynd. 4,761. February 26th.

INSULATING FISH-PLATE FOR RAILWAY OR TRAMWAY RAILS. C. J. Cooke and A. H. Johnson. 6,717. March 19th.

ELECTRICALLY-OPERATED AUTOMATIC PIANO AND LIKE PLAYERS. J. T. Sibley. 7,369. March 26th.

TURBINE DYNAMO PLANT. Warwick Machinery Co. (1908). (General Electric Co.) 7,497. March 27th.

VAPOUR-ELECTRIC DEVICES. British Thomson-Houston Co. (General Electric Co.) 7,775. March 30th.

STARTING SYSTEMS FOR INTERNAL-COMBUSTION ENGINES. J. D. Bell. 9,139. April 18th. (Cognate application, 16,768 of 1912.)

TERMINALS FOR ELECTRIC BATTERIES. H. Lucas and G. H. Jackson. 9,278. April 19th.

STATION INDICATING DEVICE FOR USE ON VEHICLES. D. J. Cooke and C. Schenck. 9,360. April 20th.

AUTOMATIC BLOCK SIGNALLING SYSTEMS FOR RAILWAYS. A. E. White. (Carson.) 10,208. April 30th.

SPEED REGULATION OF ASYNCHRONOUS MOTORS. Bergmann Elektricitäts Werke Akt.-Ges. 12,134. May 22nd. (May 22nd, 1911.)

EXCESS CONSUMPTION METER FOR ELECTRIC CIRCUITS. E. Schuppisser. 13,602. June 10th. (June 10th, 1911.)

COMBINATION ELECTRIC LAMP BULB AND DIFFUSER. E. L. Frenot. 13,776. June 12th.

ELECTRIC SWITCHES. E. B. Merriam. 14,752. June 24th. (June 23rd, 1911.)

REGENERATIVE DEVICES FOR APPARATUS FOR PRODUCING RÖNTGEN RAYS. H. Bauer. 15,171. June 28th.

TELEPHONES. E. Ramdohr. 16,241. July 11th.

PRODUCTION AND WIRELESS TRANSMISSION OF ELECTRICAL OSCILLATIONS. H. Heinicke and M. Jasper. 18,682. August 14th. (Divided application on 28,851 of 1911. December 16th.)

IGNITING CURRENT DISTRIBUTORS FOR INTERNAL-COMBUSTION MOTORS. Siemens and Halske Akt.-Ges. 19,069. August 20th. (August 26th, 1911.)

ELECTRIC WIRE TERMINAL PLUGS. C. E. Mowrer. 23,864. October 15th.

PLUG FOR ELECTRICAL PLUG CONTACTS. H. Stotz and Compagnie Elektricitäts Ges. 23,877. October 18th. (October 20th, 1911.)

DEVICES FOR ADJUSTING THE LENGTH OF THE SPARK GAPS BETWEEN ELECTRODES. O. Imray. (Compagnie Generale Radiotelegraphique.) 26,467. November 18th.

ILLUMINATED SIGNS FOR USE WITH ARC LAMPS. W. J. Beville. 229. January 3rd.

SYSTEMS OF ELECTRIC DISTRIBUTION. British Thomson-Houston Co. and A. P. Young. 627. January 8th.

ELECTRICAL MEANS FOR CONTROLLING ELECTRICALLY-DRIVEN APPARATUS. H. T. Holmes and Automatic Advertising Co. 1,569. January 19th.

BLACKLEADING MACHINES FOR THE USE OF ELECTROTYPERS. R. Hoe & Co. and F. G. Lougee. 1,968. January 24th.

DRYING OF ARTICLES MOULDED FROM CLAY, OR OTHER WET MATERIAL, MORE ESPECIALLY INTENDED FOR USE IN CONNECTION WITH THE DRYING OF MULTIPLE CHANNEL CONDUITS FOR ELECTRICAL CONDUCTORS. R. Lawton. 2,348. January 29th.

ELECTRIC SWITCHES. M. J. Railing and J. Strachan. 4,577. February, 28rd.

TROLLEY COLLECTORS FOR ELECTRICALLY-DRIVEN TRAMCARS OR ROAD MOTOR VEHICLES. E. P. B. Estler. 5,469. March 5th.

MAGNETOS USED WITH INTERNAL-COMBUSTION ENGINES. E. E. Bentall and G. C. Bingham. 5,629. March 6th.

DEVICE FOR ATTACHING OVERHEAD LINE WIRES TO INSULATORS. G. R. Paton. 5,636. March 6th.

AUTOMATIC SPARK TIMING MECHANISM FOR INTERNAL-COMBUSTION ENGINES. T. Townson. 6,077. March 11th.

SWITCHES COMBINED WITH PLUG TERMINALS FOR ELECTRIC CIRCUITS. W. E. Watson. 6,673. March 18th.

ELECTRICAL INDICATING APPARATUS. Soc. Courtaud G. Garnier, Gil et Cie. 7,780. March 30th. (April 1st, 1911.)

ELECTRIC ADVERTISING APPLIANCES. J. Meyer & Neuheiten Verwerthungs Ges. 12,133. May 22nd.

ELECTRO-MAGNETIC BRAKES. A. Thode & Co. 18,440. August 10th. (August 10th, 1911.)

APPARATUS FOR AUTOMATICALLY OPERATING GAS OR ELECTRIC LAMPS. C. R. Oliver. 23,993. October 21st. (Addition to 23,789 of 1911.)

A Technical Explanation.—One of the leading Canadian daily newspapers was describing the cause of a street car tie-up which had occurred the day before. The reporter remarked that he interviewed an expert, and in all seriousness he gave the following account of the interruption of service on the transmission line:—"If there is an electric storm in the neighbourhood of the wires, the current on the wire is protected by rotary converters, which transform the alternating current to a direct one. Sometimes the transformers are thrown out of service, and have to be started up again, causing a delay in the systems fed by the power. When this happens, the current is stepped down and out." The moral is: Be careful what you believe when you read the daily newspaper—no matter what a power it wields in the land.

Electrometallurgy in Norway.—A company, under the name of "Aktieselskabet Hybinettes Udenlandske Nickelpatenter," has recently been formed at Kristiania with a capital of £5,555, for the purpose of selling foreign patents of Engineer F. Hybinette for the production of nickel by electrolysis from nickel-copper matte, which have been acquired by the company from the inventor. As may be remembered, the Norwegian rights of the above-mentioned method have been acquired by the Kristiansand Electrical Nickel Refining Works, which have already employed the process at their works at Kristiansand for a couple of years, with great success.

At the same time a similar company has been formed at Kristiania under the name of "Aktieselskabet Hybinettes Udenlandske Kobberpatenter," with a capital of £4,177, for the purpose of selling the foreign patent rights of Engineer Hybinette for the electrolytic production of copper from copper ore and from roasted copper ore and pyrites. This process has also been commercially exploited in Norway. It may, however, be mentioned that it deals only with those ores in which the percentage of nickel does not exceed that of copper.